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The Engineer

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PUBLIC NOTICES

The Director-General, India Store Department, Belvedere-road, Lambeth, S.E. 1, invites TENDERS for—
SCHEDULE 1.—INDIA-RUBBER JOINT and ROLLING RINGS for VACUUM BRAKE.
SCHEDULE 2.—2,830 Tons STEEL TROUGH SLEEPERS.
SCHEDULE 3.—110 Tons STEEL KEYS for SLEEPERS.
SCHEDULE 4.—TWO 5-Tons STEAM TRAVELLING CRANES.
SCHEDULE 5.—300 AXLES for ROLLING STOCK.
Tenders due on the 27th July, 1928, for Nos. 1 to 3, and on the 31st July, 1928, for Nos. 4 to 5.
Forms of Tender obtainable from the above at a fee, which will not be returned, of 5s. for each schedule. 9079

Assistant Engineer REQUIRED by the GOVERNMENT of TANGANYIKA for a period of 20 to 30 months' service in the first instance. Salary £480-20-600-30-£720. An outfit allowance of £30 payable on first appointment. Free quarters, passages and liberal leave on full salary. Candidates, aged 25 to 35, must have had regular training as Civil Engineers and be Corporate Members of the Institution of Civil Engineers. Must be capable of levelling, surveying, measuring up work and preparing designs of bridges, &c. Must have had at least three years' experience under a qualified Civil Engineer on the construction of Harbour Works, Drainage Works, Water Supply, or other Public Works.—Apply at once by letter, stating age, particulars of qualifications and experience, to the CROWN AGENTS FOR THE COLONIES, 4, Millbank, Westminster, S.W. 1, quoting M/793. 9048

Assistant Engineers REQUIRED for the RAILWAY DEPARTMENT of NIGERIA, for a tour of 12 to 18 months' service, with possible extension. Salary £480, rising to £920 a year. Outfit allowance of £60 on first appointment. Free quarters and passages, liberal leave on full salary. Candidates, aged 23 to 35, should either possess an Engineering Degree of a recognised University or should have passed Sections "A" and "B" of the Associate Membership Examination of the Institution of Civil Engineers. They should also have had three or four years' regular training as a Civil Engineer, preferably on Railway Works.—Apply at once by letter, stating age, particulars of qualifications and experience, to the CROWN AGENTS FOR THE COLONIES, 4, Millbank, London, S.W. 1, quoting M/15,394. 9102

Assistant Engineers (5) REQUIRED by the GOVERNMENT of the GOLD COAST for a tour of 12 to 18 months' service, with possible extension. Salary £480 a year for three years, then £510, rising to £920 a year by annual increments. Outfit allowance of £60 on first appointment. Free quarters and passages and liberal leave on full salary. Candidates, aged 25 to 35, must be Corporate Members of the Institution of Civil Engineers, or hold an Engineering Degree or Diploma recognised as granting exemption from Sections "A" and "B" of the A.M.I.C.E. Examinations, or must hold the Testamur of the Institution of Municipal and County Engineers. Must be capable of taking complete charge of construction of Buildings, Bridges and Roads, and have a thorough knowledge of Surveying, Quantities, and Measuring-up of Work.—Apply at once by letter, stating age, qualifications, and experience, to the CROWN AGENTS FOR THE COLONIES, 4, Millbank, London, S.W. 1, quoting M/628. 9104

Chief Engineer Required by the GOVERNMENT of TRINIDAD for the Railway Department. Salary £700, rising to £800 a year by annual increments of £25. Free passages for officer selected and, should a married man be selected, for his wife and family (not exceeding four persons besides himself). Candidates, age about 35, must be A.M. Inst. C.E. or hold professional qualifications exempting from Sections "A" and "B" of the A.M. Inst. C.E. Examination. Must have been thoroughly trained in theoretical and practical engineering on a British railway and be capable of taking charge of permanent way, works and signalling equipment and the supervision and preparation of plans, estimates, accounts, reports, &c. Must have good knowledge of administration, control of labour and railway finance.—Apply at once by letter, stating age, qualifications and experience, to the CROWN AGENTS FOR THE COLONIES, 4, Millbank, London, S.W. 1, quoting M/694. 9047

Civil Engineer Required by the GOVERNMENT of CEYLON for three years' service as DISTRICT ENGINEER in the PUBLIC WORKS DEPARTMENT. Salary £500, rising to £960 a year by annual increments (a commencing salary of £600 a year in the foregoing scale will be paid to selected candidates who have attained the age of 30). Free passages. Candidates, aged between 25 and 35, should have passed the examination to qualify for Associate Membership of the Institution of Civil Engineers, and have held post as Contractors' Engineer or as Resident Engineer on Public Works with experience in costing and accounting. Must be competent in Engineering, Surveying and Setting Out, and in Levelling.—Apply at once in writing, giving age, qualifications and experience and whether married or single, to the CROWN AGENTS FOR THE COLONIES, 4, Millbank, London, S.W. 1, quoting M/849. 9049

Civil Engineer Required by the GOVERNMENT of CEYLON for APPOINTMENT as IRRIGATION ENGINEER, for three years' service in the first instance. Salary £500, rising to £900 a year by annual increments of £40 (£800 a year on attaining 30 years of age). Free quarters and free passages provided. Candidates, unmarried, 28 to 31 years of age, must have passed examination to qualify for Associate Membership of the Institution of Civil Engineers or hold professional qualifications recognised by the Institution as exempting from parts A and B of that examination, and have had at least three years' practical experience on Waterworks, Drainage, or Harbour and Dock Works.—Apply at once by letter, stating age, qualifications, and experience, to the CROWN AGENTS FOR THE COLONIES, 4, Millbank, London, S.W. 1, quoting M/732. 9090

Research Department, WOOLWICH.
REQUIRED, ONE DRAUGHTSMAN, age between 25 and 35 years. Rate of pay commencing at 35s. per week (basic) plus Civil Service bonus, making present total salary 59s. 6d. per week.
Annual leave 18 days per annum.
Candidates must have a good education and have served an apprenticeship in a first-class drawing-office. Should have good knowledge of mathematics, designing and production of finished drawings for experimental apparatus for use in machine shops.
Preference given to ex-Service men suitably qualified.
Applications to be made by letter, accompanied by copies of not more than three testimonials, to the CHIEF SUPERINTENDENT, Research Department, Woolwich, S.E. 18. 9076

County Borough of Croydon EDUCATION COMMITTEE.
WANTED in September, EVENING TEACHERS of PRACTICAL PHYSICS and CHEMISTRY for first-year students in the Engineering Department. One evening of 2 hours per week. Salary 15s. per evening.
Applications, including particulars of experience, &c., to be addressed to the PRINCIPAL, Central Polytechnic, Scarbrook-road, Croydon.—R. B. MORGAN, Education Officer, Education Office, Katharine-street, Croydon. 9067

University of Birmingham.
APPOINTMENT OF ASSISTANT LECTURER IN DEPARTMENT OF ELECTRICAL ENGINEERING.
APPLICATIONS are INVITED for the POST of ASSISTANT LECTURER in ELECTRICAL ENGINEERING. Candidates should have a University Degree in Electrical Engineering and some works training. Preference will be given to candidates with a knowledge of modern electric traction. Stipend £300 per annum. Duties to begin October 1st, 1928. Four copies of application, with testimonials or references, must be sent on or before August 11th to the undersigned, from whom further particulars may be obtained.
C. G. BURTON, Secretary.
The University, Edmund-street, Birmingham. 9053

PUBLIC NOTICES

Required for the Hyderabad STATE TECHNICAL INSTITUTE in India, a highly qualified ENGINEER with general works experience in a superior position and Honours University Degree in Engineering for the POST of VICE-PRINCIPAL. The incumbent will be responsible for supervision of technical engineering classes up to the standard of University Degree in Mechanical Engineering, for the design and manufacture of a large variety of machines and structures, for the training of boys in all the usual branches of practical engineering work, and for the general management of the State workshop. The Institute is at present training about 300 boys in theoretical and practical mechanical engineering. The State workshop is conducted on commercial lines as a general engineering factory.
The engagement will be for a period of three years calculated from the date of joining. Fixed pay offered: O.S. Rs. 1400 per month (O.S. Rs. 7 equals B.G. Rs. 6). No easement during engagement. Post is non-pensionable.
A sum of £100 will be allowed for passage money after joining and £80 for return journey.
Applications will be received by the WARDLE ENGINEERING CO., Ltd., 8, Princes-street, Storey's-gate, London, S.W. 1, up to 1st August, 1928. 9051

University of Bristol.
FACULTY OF ENGINEERING.
APPLICATIONS are INVITED for the APPOINTMENT of ASSISTANT LECTURER and DEMONSTRATOR in MECHANICAL ENGINEERING; salary £300 per annum. Forms of application and full particulars may be obtained from the REGISTRAR, Merchant Venturers' Technical College, Unity-street, Bristol, to whom applications should be forwarded on or before July 26th. 9024

University of London.
The SENATE invite APPLICATIONS for the MAYBURY (part-time) CHAIR of HIGHWAY ENGINEERING (the fund for which is provided by the Worshipful Company of Paviors), tenable at the City and Guilds College. Salary £750 a year.—Applications (12 copies) must be received not later than first post on 4th September, 1928, by the ACADEMIC REGISTRAR, University of London, S.W. 7, from whom further particulars may be obtained 9059

PUBLIC NOTICES

IN THE MATTERS OF LETTERS PATENT granted to Nestor Gabriel Auguste Marie Joseph Champy and Leon Paul Alexandre Germain Champy dated the 25th September 1912 for the invention of "Process of and relating to the Preparation of Porous Material for Filling Receptacles Intended for Storing Explosive Gases."
Notice is Hereby Given that on the 16th October 1928 an ORIGINATING SUMMONS (1928 C. No. 853) issued out of the High Court of Justice (Chancery Division) on behalf of Nestor Gabriel Auguste Marie Joseph Champy and Leon Paul Alexandre Germain Champy (the above-named Patentees) and Allen-Liversidge Limited asking that the term of the Patent may be extended for a further period of five years will come before Mr. Justice Tomlin for directions as to the hearing and any person desirous of being heard in opposition must at least 7 days before that date lodge Notice of Opposition at Room 175 Royal Courts of Justice Strand and serve a copy thereof upon the undermentioned Solicitors.
Dated this 13th day of July 1928.
KEARSEY HAWES and WILKINSON, 108a, Cannon-street, E.C. 4. 9063

Abertillery and District Water BOARD.
SALE OF PLANT.
The above Board offer FOR SALE extensive ELECTRICAL, STEAM, and other PLANT, recently used in the construction of a large Concrete Masonry Dam.
The following are some of the principal items:—
Generating Plant, consisting of No. 2 Ruston and Hornsby 230 H.P. Gas Engines and Producer Plants with No. 2 Metropolitan-Vickers 180-kW. 500-volt Dynamos.
No. 1 100 H.P. National Gas Engine and Producer Plant with No. 1 Bruce-Peebles 100-kW. 500-volt Dynamo.
No. 4 Anderson-Grice 2-Ton, 3-Motor Electric Loco. Cranes.
No. 3 Steam Derrick Cranes, 4 and 5 ton.
No. 1 14in. by 12in. Ingersoll-Rand Air Compressor with 500-volt Motor.
No. 1 Double Concrete Hoist, 180ft. high, by Stothert and Pitt, with Trussed Steel Chutes, Hoisting Winches, ¼-Yard Mixers, and 500-Volt Motors.
No. 2 Steam Locomotives, 3ft. gauge.
No. 2 Victoria Concrete Mixers, ½ and ¾-yard capacities.
Further particulars can be obtained from the Board's Engineer, Mr. J. FRANCIS JUPP, M. Inst. C.E., Midland Bank Chambers, Newport, Mon. 9091

Bombay, Baroda and Central INDIA RAILWAY COMPANY.
The Directors are prepared to receive up to Noon on Wednesday, 15th August, TENDERS for the SUPPLY of:—
STEEL TRESTLES AND GIRDERS.
Tenders must be made on forms, copies of which, with specification, can be obtained at these offices on payment of 20s. each (which will not be returned).
The Directors do not bind themselves to accept the lowest or any Tender.
S. G. S. YOUNG, Secretary.
Offices: The White Mansion, 91, Petty France, Westminster, S.W. 1, 18th July, 1928. 9077

City of Birmingham Gas De- PARTMENT.
SALTLEY WORKS.
FOR SALE.
Complete BOILER PLANT, with BOILER-HOUSE, TWO CHIMNEYS and FUEL BUNKERS, together with:—
THREE 28ft. by 8ft. LANCASHIRE BOILERS for 110 lb., 1911 and 1915.
ONE 29ft. 6in. by 8ft. LANCASHIRE BOILER for 110 lb., 1913.
THREE 30ft. by 8ft. LANCASHIRE BOILERS for 100 lb., 1903.
The above complete with a 216-tube Economiser, Superheaters, Hopkinson's Boiler Mountings, Steam and Feed-water Mains. The plant can be inspected and full particulars obtained from the Engineer.
Tenders to be for the complete demolition and removal of the boiler-house and plant from the works.
Tenders to be addressed to the CHAIRMAN of the GAS COMMITTEE, Gas Department, Council House, Birmingham, not later than 9 a.m. on August 4th, 1928. 9056

City of Coventry, Water De- PARTMENT.
15 H.P. NATIONAL GAS ENGINE, complete with Circulating Pump, Water Tank, Exhaust Silencer, Box, &c., together with set of THREE-THROW WELL PUMPS with a capacity of from 25,000 to 30,000 gallons per hour at 50ft. total head. Belt and gear drive. In good order. Can be seen in operation by appointment. FOR SALE complete or offers will be considered for Engine or Pumps separate. 9050

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PUBLIC NOTICES

Dundalk Harbour Commissioners.

DUNDALK HARBOUR AND PORT.
PROPOSED IMPROVEMENT OF QUAY WALL AND NEW FERRO-CONCRETE WHARF AT RAILWAY QUAY, DUNDALK.
TO CONTRACTORS.

The Dundalk Harbour Commissioners invite TENDERS from competent contractors for the proposed NEW WORKS at Dundalk Harbour, comprising a New Facing and Strengthening of Existing Quay Wall known as Railway Quay for a length of 557ft. 4in., and a New Ferro-concrete Wharf, 210ft. long, in front of remaining portion of said Railway Quay, and all other work incidental thereto, in accordance with the plans, specifications and conditions of contract, which may be inspected at the office of the Engineer, Mr. P. H. McCarthy, B.A.I.M. Inst., C.E.I., 26, Lower Leeson-street, Dublin, or at the Harbour Commissioners' Office, Dundalk, during the usual office hours.

Copies of the specifications and schedules of quantities and forms of Tender may be obtained from the undersigned on payment of a deposit of £20, which will be returned on receipt of a bona fide Tender, together with all the aforesaid documents.

Tenders, enclosed in sealed envelopes and addressed to the Chairman, Dundalk Harbour Commissioners, Harbour Commissioners' Office, Dundalk, and marked "Tender, New Quay and Wharf," to be delivered at the said office on or before Ten o'clock a.m. on Tuesday, 28th day of August, 1928.

The Commissioners do not bind themselves to accept the lowest or any Tender nor will the Commissioners be responsible for any expenses incurred by persons tendering.

MARY MALLON,
Secretary,
Dundalk Harbour Commissioners.
Harbour Commissioners' Office, Dundalk. 9090

Guardians of the Poor of the PARISH OF WILLESDEN.

NEW BOILER AND GENERATING SETS.

The Guardians of the above are prepared to invite TENDERS for ONE NEW BOILER at the Park Royal Hospital, Acton-lane, Willesden. Firms wishing to Tender to the plan and specification now being prepared by the Guardians' Consulting Mechanical Engineer, Mr. W. M. Binny, A.M.I.C.E., are requested to send their names to the Clerk with reference to similar recent work carried out by them at other Institutions.

Firms are requested in the first instance to visit the Hospital and see the existing boilers. The new boiler to be preferably of the same pattern, but alternative offers for other designs that can be installed in the space available will be considered.

Also for TWO 90-KILOWATT DIRECT-COUPLED SETS to the specification of Messrs. Couzens and Brown, the Guardians' Consulting Electrical Engineers. Firms are requested to visit the Hospital and view the existing sets. The sets to be of the high-speed direct-coupled type.

Firms selected to Tender will be provided with a plan, specification and form of Tender when ready on paying a deposit of £5, which will be returned on receipt of a Tender properly filled in.

Applications to be allowed to Tender must be received by the Clerk to the Guardians (at the offices as below) not later than July 30th, 1928.

By Order,
J. HUTTON HAYLOR,
Clerk to the Guardians.

Guardians' Offices,
409, High-road, Brondesbury, N.W. 6,
July, 1928. 9046

The Corporation of the County Borough of Londonderry

are prepared to receive OFFERS from competent persons for the PURCHASE and REMOVAL of the STEAM PUMPING ENGINE at Burngibbagh Pumping Station.

The engine is compound tandem type with superheater and condenser, 170 B.H.P., at 180 revs., made by Messrs. Ruston, Proctor and Co., in 1911.

Particulars can be obtained and the plant examined on application to Mr. M. A. Robinson, City Engineer, Guildhall.

Offers, in sealed envelopes endorsed "Burngibbagh Engine," are to be lodged with me on or before Twelve o'clock Noon on 9th August, 1928.

The Corporation do not bind themselves to accept the highest or any of the Offers.

F. HENRY MILLER,
Town Clerk.
Guildhall, 17th July, 1928. 9093

The South Indian Railway Company, LIMITED.

The Directors are prepared to receive TENDERS for the SUPPLY of—

STEELWORK FOR BRIDGES.

Specifications and forms of Tender will be available at the Company's Offices, 91, Petty France, Westminster, S.W. 1.

Tenders addressed to the Chairman and Directors of the South Indian Railway Company, Limited, marked, "Tender for Steelwork for Bridges," must be left with the undersigned not later than Twelve Noon on Thursday, the 30th August, 1928.

The Directors do not bind themselves to accept the lowest or any Tender.

A charge, which will not be returned, will be made of 10s. for each copy of the specification.

Copies of the drawings may be obtained at the Offices of the Company's Consulting Engineers, Messrs. Robert White and Partners, 3, Victoria-street, Westminster, S.W. 1.

A. MUIRHEAD,
Managing Director.
91, Petty France,
Westminster, S.W. 1,
18th July, 1928. 9099

Egyptian Government.

MINISTRY OF COMMUNICATIONS.
TELEGRAPHS AND TELEPHONES ADMINISTRATION.

A DEPUTY INSPECTOR-GENERAL OF TELEGRAPHS and TELEPHONES is REQUIRED by the above Administration in Egypt.

QUALIFICATIONS.—Candidates must have had considerable technical and administrative experience of Telegraphs, Telephones and Wireless, with some knowledge of International Conventions and Telegraph Regulations, and, if possible, a good working knowledge of French.

SALARY.—The appointment will be made in the £E1250-1400 grade, with an increment of £E100 after two years' service, the salary on appointment being fixed according to qualifications.

TERMS.—The contract will be for four years. An allowance equal to one month's salary will be granted for change of residence from England to Egypt and vice versa.

Application form and specimen form of contract can be obtained from—

THE CHIEF INSPECTING ENGINEER,
Egyptian Government,
41, Tothill-street,
9103 London, S.W. 1.

Egyptian State Railways.

REQUIRED, ONE LOCOMOTIVE DRAUGHTSMAN, salary £E360 per annum on contract for three years (£E1 equals £81 9s. 6d.). Applicants should have been employed as fully qualified draughtsmen in a locomotive drawing-office of a first-class railway and have had practical experience of at least 5 years in a locomotive builder's workshop. A knowledge of carriage and wagon designing is an additional asset. The duties will be to take charge of detail work in the preparation of complete drawings of locomotives, watching necessary calculations, and he should also be a capable designer.

Application should be made to

THE CHIEF INSPECTING ENGINEER,
Egyptian Government,
41, Tothill-street, London, S.W. 1,

from whom copy of application form and copy of contract form can be obtained.

All communications should be marked at top left-hand corner "Locomotive Draughtsman." 9045

PUBLIC NOTICES

Manchester Corporation.

WANTED, TWO JUNIOR ASSISTANTS in the Highways Department, at a commencing salary of £215 per annum. Applicants should have had a course of training at a recognised Engineering College and at least one year's practical experience in levelling, surveying, and getting out plans and specifications for street works. The appointments will be probationary for six months, after which they will be permanent.—Applications, with copies of two recent testimonials, endorsed "Junior Assistant," to be sent to CITY ENGINEER, Town Hall, Manchester, not later than 3rd August, 1928. 9094

SITUATIONS OPEN

COPIES OF TESTIMONIALS, NOT ORIGINALS, UNLESS SPECIFICALLY REQUESTED.

WANTED, CLERK OF THE WORKS, for the erection of a Beet Sugar Factory, with experience of Concrete Work and General Plant Erection. Age not under 35; salary £500 p.a.—Address, 9084, The Engineer Office. 9084 A

WANTED, COMMERCIAL ENGINEER, with a wide technical and practical knowledge of modern Double Helical Gear Cutting; competent to estimate, design and follow up inquiries. Good prospects for right man. State, in confidence, present employment, age, wages, experience.—Address, 9101, The Engineer Office. 9101 A

WANTED for India Early in 1929, First-class MECHANICAL ENGINEER; one used to Cement Works Machinery preferred. Must be young, steady man, capable of controlling labour and not afraid of hard work; must be experienced in all repair work, locos., boilers, turbines, cranes, foundry work, &c. Good opportunity for smart man. Three years' engagement, passage out and home. Salary, Rupees £1000 per month, with free furnished quarters. Interview by appointment.—Address, giving full particulars experience, P4743, The Engineer Office. P4743 A

WANTED IMMEDIATELY for India, CEMENT WORKS MANAGER; must be very capable man, used to wet process and rotary kilns. One with Chemical or Engineering Training preferred. Three years' agreement, passage out and home.—Address immediately, giving full particulars as to experience and salary required, P4779, The Engineer Office. P4779 A

WANTED, MECHANICAL ENGINEER, with thoroughly sound Machine Shop and Drawing-office Experience, to collaborate on Mechanical Design and Construction of a new Automatic Machine, and afterwards proceed to British Dominion to Take Charge of Constructing Machines there. The position offers splendid opportunities to the right man, but the standard required is high. Knowledge of Gasman an advantage.—Address, in confidence, stating age, experience, when free, &c., 9105, The Engineer Office. 9105 A

WANTED, WORKS MANAGER, About 30. Must be thoroughly competent Engineer and had good experience in high-class Press Work.—Address, stating salary required, to 9081, The Engineer Office. 9081 A

CHEMIST.—WANTED IMMEDIATELY, First-class experienced CHEMIST for private Cement Works in India; must be young, energetic man, and capable of Taking Complete Charge of the Manufacture of Portland Cement in all its branches. Three years' agreement, with passage out and home, and furnished quarters. Good climate.—Address, giving full particulars of experience and salary required, P4778, The Engineer Office. P4778 A

CRANE SALESMAN REQUIRED, with Sound and up-to-date knowledge of present-day Electric Crane practice. None but men of experience need apply.—Address, giving full particulars of experience and salary expected, 9057, The Engineer Office. 9057 A

DISTRICT ENGINEER WANTED by Important Petroleum Interests in Venezuela. Desirable candidates should be members of Institutions of Civil and Mechanical Engineers, and have had experience of Public Works Contracts, preferably abroad. Three years engagement, first-class passage out and home on completion of contract, and outfit allowance provided. 550 dols. (U.S. currency) per month.—Apply, giving age and full particulars of qualifications, training and experience, to Z.S. 293, care Deacon's Advertising Agency, Fenchurch-avenue, London, E.C. 3. 9089 A

ENGINEER REQUIRED in Connection with the taking of particulars and making investigations preparatory to Sale of Gas Producers.—Write, stating age, salary, giving full details of experience, Z.E. 237, c.o. Deacon's Advertising Agency, Fenchurch-avenue, E.C. 3. 9098 A

ENGINEER.—WANTED IMMEDIATELY, First-class MECHANICAL ENGINEER for private Cement Works in India; must be young, energetic man and capable of Taking Complete Charge of Boilers, Turbines and all Cement-making Machinery. Three years' agreement, with passage out and home, and furnished quarters; good climate.—Address, giving full particulars of experience and salary required, P4777, The Engineer Office. P4777 A

GENTLEMEN WANTED to REPRESENT (on Commission basis) progressive FIRM of Reinforced Concrete and Steel-frame Building Specialists in important industrial centres. Only those with established connections need apply.—Write, INDUSTRIAL CONSTRUCTIONS, Ltd., 44, Grosvenor-place, London, S.W. 8955 A

MANAGER for Office of Concrete Specialists and Contractors in the Far East; must be capable business man of highest integrity, energetic, with initiative, good organiser and of good address. One with some knowledge of Engineering preferred. State age, qualifications, experience and salary required.—Address, P4772, The Engineer Office. P4772 A

PROCESS ENGINEER WANTED by Engineering concern in the North of England, who is thoroughly conversant with the most up-to-date manufacturing practice; able to personally introduce and develop new methods and special purpose machines for general electrical and turbine work and erection of same. Only men who possess first-class qualifications and are thoroughly able to meet above requirements should apply. Full details of experience and qualifications, age, salary required, and date when free to be given.—Address, 9052, The Engineer Office. 9052 A

REPRESENTATIVES REQUIRED for North-East and Clyde Districts by Firm of Refrigerating Engineers. Must have sound technical knowledge of Ship and Land Installations and business ability. Salary and commission basis.—Address, 8951, The Engineer Office. 8951 A

REQUIRED IMMEDIATELY, ASSISTANT to MANAGER of large works in London, age 21 to 25; must be conversant with modern Machine Tools and capable of dealing with correspondence; a knowledge of shorthand and typewriting would be an advantage.—Address, 9073, The Engineer Office. 9073 A

THE CHIEF ENGINEER of a Large Concern in London REQUIRES a PERSONAL ASSISTANT. Applicants must have had a public school education, a sound theoretical and practical training in electrical and mechanical engineering, and a knowledge of modern workshop practice. Age 25 to 30. Commencing salary £400 per annum. The position is permanent and progressive to a suitable man. Give full particulars of education and experience in confidence.—Address, P4765, The Engineer Office. P4765 A

TURBO-COMPRESSOR DESIGNER.—An Experienced MAN REQUIRED, capable of Taking a Leading Position in Drawing-office.—Apply by letter, stating age, previous experience and salary required, to REAVELL and CO., Ltd., Ipswich. 9085 A

SITUATIONS OPEN (continued)

WANTED, DRAUGHTSMEN, Used to Detailing Structural Steel Work. Permanency for suitable men. State experience and salary required.—Address, P4780, The Engineer Office. P4780 A

WANTED for London Office, MECHANICAL and STRUCTURAL DRAUGHTSMEN; must have first-class experience in Mechanical Handling Plants and Power Station Design. Capable of Taking Charge of large Contracts essential. Also MEN fully experienced in Proposal Work REQUIRED.—Address, stating age, experience and salary, P4782, The Engineer Office. P4782 A

ASSISTANT DRAUGHTSMAN WANTED on the South Coast (Sussex), for General Water Engineering Work. Salary £3 10s. per week. State experience, age, and if disengaged.—Address, P4768, The Engineer Office. P4768 A

DRAUGHTSMAN, Experienced in Fan Systems, particularly dust, &c., extracting and accurate balancing of same. To be trained as Engineer Representative. Age 20-25. Good prospects. Fullest particulars in writing.—BIRMINGHAM FAN CO., Ltd., 122/3, Livery-street, Birmingham. P4795 A

DRAUGHTSMEN, First class, REQUIRED for South of England, with Mechanical and Structural Experience in Transporters and Conveying Plant. Capable of handling complete contracts. Also STRUCTURAL DETAILERS.—Write, experience, age, salary required, to Box 518, Sells, Fleet-street, E.C. 4. 9095 A

DRAUGHTSMAN for Small London Constructional Engineering Works; calculations, shop and outside; L.C.C. buildings, &c.; good prospects.—Address, P4783, The Engineer Office. P4783 A

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For continuation of Small Advertisements see page 3.

A Seven-Day Journal

Civil Aviation Subsidies.

IT has been known for some time past that the British Air Ministry was on the point of concluding a new subsidy agreement with Imperial Airways, Ltd., in substitution of the agreement entered into in May, 1924, and subsequently modified in December, 1925, and again in October, 1926. During the past seven days the terms of the new agreement were made public in a notice signed by Sir Samuel Hoare, the Minister for Air. This new agreement will come into force on April 1st, 1929, and will replace all existing agreements. It will remain in force for ten years. During each of the first two years the maximum subsidy will be £335,000 and during each of the next four years it will be £310,000. In the remaining four years it will be successively £220,000, £170,000, £120,000, and £70,000. The total maximum subsidy to be paid will therefore be £1,225,000. The services to be provided by the company will cover the existing daily services on certain European routes with a minimum of 425 million horse-power miles per year and a weekly—and, if possible, later on a twice weekly—service each way between England and Egypt. In effect the new agreement extends to fifteen years, the period of ten years during which the original agreement of 1924 contemplated commercial air transport becoming self-supporting. For the England-Egypt service the company is to be given two "Calcutta" flying boats recently completed under the civil aircraft experimental programme. Under the agreement of May, 1924, the company is bound to apply one-third of its profits after paying a dividend of 10 per cent. on its paid-up capital to the repayment of the subsidies which it receives from the Government. In the new agreement this provision is abandoned and instead the Government is to receive an allotment of deferred shares in the company carrying a right to half the excess remaining after 10 per cent. has been paid on the ordinary shares. The Government retains the right to nominate for the board of the company two Government directors.

Charing Cross Bridge.

THE meeting held on Thursday of last week, July 12th, between representatives of the Ministry of Transport, the London County Council, and the Southern Railway to discuss the scheme for a new road bridge at Charing Cross, would appear to have passed off without clarifying the outlook to any great extent. On behalf of the Southern Railway General Baring emphasised the company's view that the removal of Charing Cross Station to the south side of the river would cause substantial inconvenience to the travelling public and possibly loss to the shareholders. Sir Percy Simmons, Chairman of the L.C.C. Improvements Committee, favoured the scheme as modified by the proposal to construct the new terminus near the edge of the river between Waterloo Bridge and the County Hall instead of on the site now occupied by Waterloo Junction Station. General Baring eventually undertook to consider the scheme "on the understanding that the Government regarded the removal of the present station as vital to a satisfactory improvement, and subject to its being possible to arrive at terms satisfactory to all parties." He added that it would be necessary for him to consult his shareholders. It is understood that the modification of the scheme will slightly increase the estimated cost of carrying out the work, namely, from £10,770,000 to about £10,900,000, and that roughly the expenditure will be divided in the proportion of £6,500,000 to the acquisition of property and compensation—including the compensation to be paid to the Southern Railway—and £4,500,000 to the construction of the new bridge and other works.

Pulverised Fuel on a Cargo Liner.

IN a Journal note published in our issue of May 18th we referred to the proposal of the Blue Star Line (1920), Ltd., to fit Woodeson pulverised fuel equipment to a single-ended boiler on one of its South American cargo liners, in order to test the equipment during a long voyage. Last week the twin-screw refrigerated liner "Stuartstar," of 12,000 tons deadweight carrying capacity, left the Tyne with one of her boilers so fitted, and she is now south of Las Palmas on her way to Buenos Aires. The equipment, which was supplied by Clarke, Chapman and Co., Ltd., of Gateshead, comprises a single unit consisting of a motor-driven pulveriser and blower together with a feeding hopper and bin, which are mounted on a single bed-plate and take up very little room in the space arranged in the cross bunkers forward of the stokehold. Delivery pipes carry the powdered fuel to the four furnaces of one of the single-ended boilers. The other single-ended boiler and two double-ended boilers are hand fired with coal. The work of installing the plant was carried out by Palmer's Shipbuilding and Iron Company, Ltd., at Hebburn, and within eight days all the necessary alterations were made, the plant installed, and a successful preliminary trial run. It is found that the powdered coal is evenly delivered to all four furnaces without the aid of any mechanical distributing gear, and starting from this very simple basis the equipment will be further developed under sea-going conditions until the flexibility requisite for starting and manœuvring is obtained. For the present voyage a small coal of medium quality is being used. The "Stuartstar" will return to London about August 30th. Her owners are to be congratulated on making an experiment of such prime importance with powdered fuel equipment of entirely British design.

A Japanese Shipbuilding Programme.

AT a luncheon held on the Nippon Yusen Kaisha liner "Fushimi Maru," in the Royal Albert Dock, last week, Mr. Ohtani, managing director of the company, who is at present visiting this country, made an interesting reference to the extensive motor shipbuilding programme which his firm is now carrying out in Japan. There are under construction in that country three 16,500 gross ton 19-knot motor passenger liners for the Japan-San Francisco service, three 11,000-ton 16-knot motor passenger and cargo vessels for the Japan-Seattle route, and a 9500-ton 15-knot motor ship for the company's South American trade. Some of these ships are to be propelled by Sulzer type two-cycle oil engines and others by four-cycle machinery of the Burmeister and Wain type. The auxiliary oil engine-driven generator sets are being built by W. H. Allen, Sons and Co., Ltd., of Bedford, and successful trials were recently run on the first engines of the series on order. Mr. Ohtani went on to say that the programme included two other 16-knot motor vessels for the European mail service, each of 10,500 gross tons. It has not yet been decided whether these orders will be placed in Japan or England, but hopes are entertained that British shipbuilders may be successful in obtaining them. When the present programme of building is completed in 1931 a total of approximately £8,000,000 will have been spent on new vessels, and the fleet of the Nippon Yusen Kaisha will then consist of 153 ships, aggregating 887,000 gross tons.

A Quarter's Wreck Returns.

THE return of wrecks recently published by Lloyd's Register of Shipping for the quarter ending December 31st, 1927 shows that within the period under review the gross reduction in the world's mercantile marine arising from all causes, whether by loss at sea or breaking up, was 282,058 gross tons. This total included 197 steamers, motor vessels, and sailing ships, of which 123, aggregating 165,546 gross tons, were lost at sea, while the remaining 74 ships, representing 116,512 tons, were broken up. In the first-named class the proportion of British-owned ships to those of other countries was 23 to 100, and in the second-named class the ratio was 22 to 52. If the losses arising from all causes be taken into account, then the percentage loss of tonnage owned in Great Britain and Ireland is only 0·09, and on a basis of ships owned 0·28. Among the large ships which were broken up was the Union Castle liner "Kilfauns Castle," of 9655 gross tons, and the French liner "La Savoie," of 11,168 gross tons. In the period named the Italian mercantile marine suffered a severe loss by the foundering of the 9210-ton South American liner "Principessa Mafalda" off the coast of Bahia.

Petters, Ltd.

IT is encouraging to hear in these hard times of any engineering firm earning satisfactory profits, and doubly encouraging when such a firm can report that its works show signs of continuing to be well employed. Speaking last week at the eighteenth annual general meeting of Petters, Ltd., Yeovil, Sir Ernest Petter stated that after allowing for depreciation, taxation, and bad debts, the firm's net profit for the year was £25,634, and that, adding the amount brought forward from the previous year, there was a disposable balance of £44,445. In addition to paying interest on the preference shares, it was proposed to pay a dividend of 6 per cent. on the ordinary shares. In the engine department there had, Sir Ernest remarked, been a decided hesitation in the home trade, largely because of the condition in which British agriculture found itself, a condition which affected adversely the demand for small oil engines. Nevertheless, both home and export sales of the firm's engines had increased. In the aircraft department there continued to be a marked paucity of orders during a large part of the year, but thanks to the efforts made by the design and research departments, machines had been produced which had won the approval of the Air Ministry, and an important contract had been received during the second part of the year. Two or three other developments now in hand would, it was hoped, keep the aircraft department in satisfactory employment for some time to come. Dealing with the firm's acquisition of Vickers' share in the Vickers-Petters works at Ipswich, Sir Ernest said that a few months' experience had shown that under existing conditions, it would not be possible to place the undertaking on a profit-earning basis. The business had been seriously handicapped by onerous contracts entered into before Petters, Ltd., took sole control. The economies essential to success could not be obtained with the works situated some 200 miles from the base of management. It had therefore been decided to close down the Ipswich works at the end of the present year, and to resume the manufacture of the larger size of engine at Yeovil. That change would involve the provision of new shops and machinery.

United States Mails Contract.

ON November 15th last year the agreement expired between the Postmaster-General and the Cunard Steamship Company for the weekly conveyance of mails to and from the United States. That agreement was dated July 30th, 1903, and provided for a fixed annual payment to the company of £68,000. Last week the terms of the new contract with the company were published by H.M. Treasury. This new contract is dated June 27th, 1928, and is to run for a term of five years from November 16th, 1927, continuing thereafter from year to year subject to twelve months' notice on either side. In recognition of the increased volume of the mails and the increased cost of conveying them the remuneration to the company is to be raised to £100,000 per annum. There will, however, be a variation amounting to half the ascertained increase or decrease in the event of the volume of the mails increasing or decreasing by 8 per cent. or more. It is provided under the agreement that certain of the mail ships to be agreed upon between the Admiralty and the company are to have their structures stiffened sufficiently to enable them to carry an armament of guns not exceeding 6in. in calibre. The cost of this stiffening is to be borne by the Admiralty. The agreement also stipulates that the company will encourage the practice of the Admiralty system of signalling, both visual and wireless, with men-of-war, signal stations and merchant vessels, that it will co-operate in the distribution of Naval intelligence, and that it will foster the Royal Naval Reserve movement among its staffs.

William Beardmore and Co., Ltd.

As certain statements have appeared in the daily Press regarding the reconstruction of the management and staff of the various works of William Beardmore and Co., Ltd., we have taken steps to ascertain the true position, and are enabled to give the following outline of it. As recorded in these columns some months ago, the directors invited a special committee to investigate the affairs of the company, and the report of that committee will be made in due course. Meanwhile, the directors, with the full knowledge of the committee, have recently taken steps to place the present volume of business on a paying basis. The policy pursued has involved certain reductions in the management and staff at the company's Parkhead Works, but no change has been made in the working conditions and rates of pay of the workmen. The men, we understand, clearly recognise that in the past the expenses of management have been much too heavy, and they are lending their loyal support to the changes which are in progress. As a result of the more competitive prices which are now possible, the outlook as regards orders shows, we learn, a marked improvement. At Dalmuir and Mossend, only minor changes commensurate with a temporary depression in trade, have been made end with the prospect of new orders it is possible that some men will be reinstated.

New Steamers for Canada and the West Indies.

ON Tuesday last, July 17th, there was successfully launched from the Birkenhead yard of Cammell Laird and Co., Ltd., the twin-screw turbine steamer, the "Lady Nelson," which is the first of a fleet of five vessels which are being constructed and engined by the firm to the order of Canadian National (West Indies) Steamships, Ltd., of Montreal. The new ships are to operate in conjunction with the Canadian National Railways, and will inaugurate a fortnightly service between Canada and the British West Indies. Like her sister ships, the "Lady Nelson" has a length between perpendiculars of 437ft. 3in., a beam of 59ft., a depth of 31ft. to the upper deck, with a measurement of 7650 gross tons and a designed service speed of 14 knots. She has a single funnel, and two pole masts, and with her straight stem and elliptical stern, she should present a pleasing appearance. There are six decks, two of them continuous, upon which is arranged unusually well-appointed accommodation for 103 first-class passengers. Additional accommodation for second and third-class passengers is also provided. The four holds of the ship, together with the 'tween deck spaces, are arranged for the carriage of both general and refrigerated cargo, in addition to which cooled spaces for bananas have been provided. The propelling machinery, which is now being installed, includes twin-screw single-reduction geared turbines of the Parsons type, each set consisting of a high-pressure and a low-pressure turbine, with the astern turbine arranged in the low-pressure turbine casing. Steam will be raised in four oil-fired single-ended cylindrical boilers, which will be fitted with superheaters and will work under forced draught. Both the engine-room and deck auxiliaries are steam driven. The construction of the hulls and the machinery is being supervised for the owners by A. T. Wall and Co., of Liverpool.

THE PADIHAM ELECTRIC GENERATING STATION

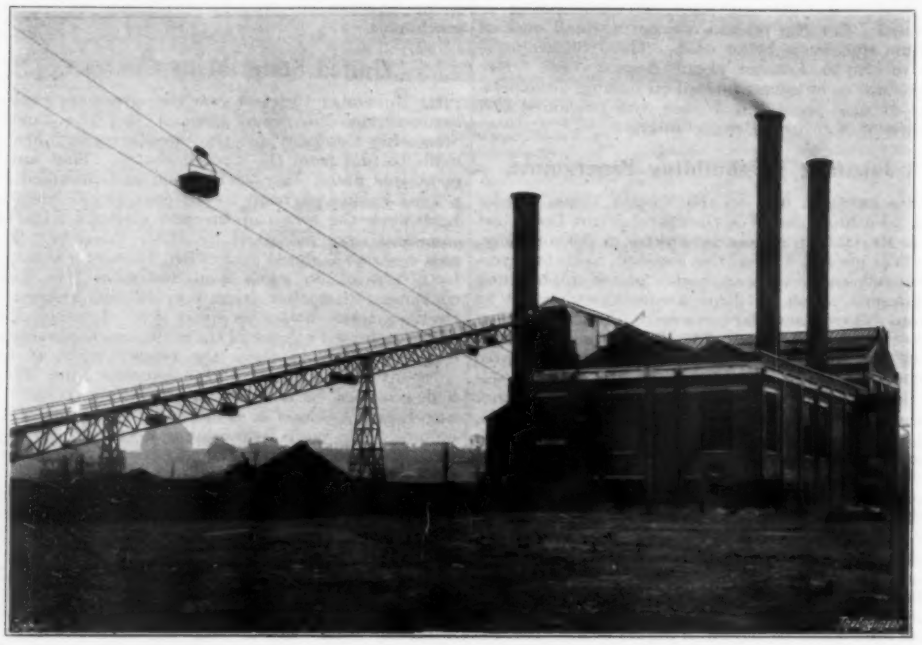

FIG. 1—GENERAL VIEW SHOWING INCLINED AND AERIAL ROPEWAYS

The Padiham Station of the Lancashire Power Company.

No. I.

THE Lancashire Power Company has long enjoyed a most enviable reputation for the economical generation of electricity. The main station of the company at Radcliffe has held for years a place very near the head of the list of all the five or six hundred British public stations in respect of the lowness of its fuel consumption. That a station nearly twenty-five years old, working with steam at the very low pressure of 150 lb. per square inch, and the equally low temperature of 500 deg. Fah. at the turbine stop valves, could produce a kilowatt-hour of saleable energy for about 1·75 lb. of coal, and so hold its own against modern plants of a far more pretentious nature, is certainly a remarkable tribute to its design and management. The fact that such results could be obtained, in spite of what most people would regard as quite obsolete steam conditions, lent a special interest to the announcement that the company was about to erect a new station at Padiham, and particulars of the design and performance of this plant were awaited by engineers with more than usual eagerness. The Padiham station has now been in operation for more than a year, and by the courtesy of Dr. H. F. Parshall, the chairman, and Mr. C. D. Taite, the engineer and manager of the Lancashire Power Company, we are able to describe its main features and to give a summary of the results obtained since it was started.

Since the design of the Padiham station is the natural outcome of the experience gained at Radcliffe, it will be better appreciated if we first refer briefly to some of the characteristics of the older plant. The Radcliffe station commenced supply in 1905, with four vertical B.T.H. turbines of 1500 kW each and six land-type Babcock and Wilcox boilers, each with a rated capacity of 20,000 lb. of steam per hour. To-day the station contains nine turbines of an aggregate capacity of 68,875 kW. Throughout the various extensions which have taken place, the company has remained faithful to the land-type longitudinal-drum Babcock boiler, with brick settings and independent cast iron vertical Green's economisers. Equal fidelity has been shown in respect of the turbines, all having been supplied by the British Thomson-Houston Company. The original steam pressure of 160 lb. in the boiler drums, with a temperature of 520 deg. at the superheater outlets has been similarly adhered to. Chain grate stokers are used throughout, but there is neither forced draught nor air heating. Induced draught fans assist the natural draught when required. With such a plant, simple to the last degree, and devoid of all the refinements so often thought essential to economical operation, results are consistently obtained which may well be envied by undertakings possessed of far more elaborate equipment. As evidence of this, we show in Table I. a summary of the operating results of the Radcliffe station for the last five years.

In comparing the Radcliffe performances with those of other stations, the handicap under which Radcliffe suffers, at least theoretically, from its low steam pressure and temperature, must be taken into account. The adiabatic heat drop, taking boiler conditions, is only 396·2 B.Th.U. per pound of steam, as compared with 497·3 B.Th.U. for a modern station using steam at 375 lb. gauge and 750 deg. temperature, a 29in. vacuum being assumed in both cases. The low superheat is furthermore disadvantageous to the turbine performances, and the thermal cycle is also theoretically inferior to modern practice, in that steam is not extracted from the turbines for feed heating. It should also be noted that the fuel consumption and the thermal efficiency are calculated on the amount of power actually delivered to the feeders, and not, as is so often the case, on the total number of units generated by the machines. The latter practice makes the figures look better, but it is unjustified, for the power used in the station itself is not really "output" and has no commercial value. At Radcliffe the difference between the gross and net output of electricity is unusually small, the number of units consumed in the station being only about 3 per cent. of the total number generated. Such good results are not due to the use of steam-driven auxiliaries, for all auxiliary power other than that for boiler feeding is furnished electrically. The low station power consumption is to some extent due to the natural advantages of the site, which permit of the descent of the coal by a gravity runway from the railway at a high level to the bunkers in the boiler-house. There are, moreover, no cooling towers requiring extra pumping power. The very small use of fan draught also plays an appreciable part in the economy of power in the station itself. The question of minimising station power requirements is one that deserves more attention than it gets at the hands of most designers who strain after thermal efficiency with one hand only to throw much of it away with the other. It must always be remembered that every kilowatt-hour saved in the station itself is an extra kilowatt-hour of output from the same quantity of fuel, a fact which has been given its full weight in the design both of Radcliffe and Padiham.

The brief outline we have given of the Radcliffe station is sufficient to show that particularly good operating results are consistent with very great simplicity of plant; indeed, one can hardly doubt that they are due to this feature, combined with the good operation which simplicity favours. When the opportunity came for the construction of an entirely new station on a virgin site at Padiham, it was but natural that an improvement on the Radcliffe results should be aimed at, and all the later developments of power station engineering were thoroughly considered, both from the commercial and technical aspects. The conclusion finally arrived at was that the principles which had made Radcliffe so successful were the principles to be relied on, and that no important departure from the design of the older plant would justify itself in practice. In these days of pulverised coal firing, high steam pressures and temperatures, steam reheating, air heating, regenerative feed heating, automatic boiler control, and all the rest of the innovations of the last few years, it took moral courage to arrive at such a decision. The most effective answer to those who might criticise the Padiham plant on its lack of "modernity" is to ask such critics to point to any one of the more

TABLE I.

Item.	1927.	1926.	1925.	1924.	1923.
Units generated	119,243,020	120,785,153	131,315,948	124,619,353	107,169,643
Units delivered	114,935,780	116,441,030	127,473,470	121,194,410	104,078,020
Units used on works	4,307,240	4,344,123	3,842,478	3,424,943	3,091,623
Percentage used on works	3·51	3·64	2·93	2·75	2·88
Maximum load on feeders	52,800	49,320	47,060	41,500	37,240
Load factor, per cent.	24·84	26·95	30·90	33·33	31·9
Calorific value of coal	11,940	11,280	11,900	11,720	11,820
Coal per unit delivered	1·73	1·83*	1·72	1·79	1·82
Evaporation per unit delivered	13·17	13·29	13·27	13·67	14·16
Vacuum at turbo exhaust	29·08	28·99	28·92	28·90	28·80
Boiler-house efficiency	76·6	77·63	77·39	77·15	76·9
Turbine-house efficiency	22·38	21·95	22·19	21·68	21·19
Turbine-house efficiency ratio	70·4	69·87	69·92	68·31	67·8
Overall efficiency units delivered	16·51	16·52	16·63	16·21	15·86

* Coal strike.

FIG. 2—ARRANGEMENT OF ECONOMISERS

elaborate and more costly stations which can actually show better overall results, due regard being paid to size and load factor. A station built complete for £12·7 per kilowatt, producing only 45 million kilowatt-hours per annum on a load factor less than 35 per cent., and running with an overall thermal efficiency of over 20 per cent., based on units generated, needs imitation rather than justification. But we anticipate, and will now turn to a consideration of the plant itself.

The station is situated on the outskirts of the town of Padiham, on the river Calder. Its main duty is to provide for the load of the Lancashire Power Company in the Mid-Lancashire district, though it is interconnected by 33,000-volt cables with the company's Radcliffe station, 21 miles south, and with the large Barton station of the Manchester Corporation, some 12 miles further south. The general appearance of the station is shown in Fig. 1. The lay-out has been arranged for an ultimate plant capacity of about 60,000 kW, of which about half is now installed. The site provides a fair supply of condensing water, but a dam had to be constructed across the river, raising its level by about 4ft., in order to get a sufficient head over the intake pipes. The company was compelled by the Electricity Commissioners to put down two cooling towers, each capable of reducing 3·5 million pounds of water per hour from 92 deg. to 80 deg. Fah., but they have never been put into service, as there is no necessity for their use at present.

Coal is brought by rail to a siding on the company's property, the rails being on a hillside, which greatly facilitates unloading. The wagons are marshalled by an electric locomotive worked by direct current on the overhead trolley system. They are run in turn over an unloading hopper, and tipped by electric rams. Coal from this hopper is run into skips, and is carried in them to the bunkers up the inclined ropeway shown in Fig. 1. The skips are dumped automatically into the bunkers at any desired point, and return to the hopper to be refilled. The coal ropeway has a capacity of 30 tons per hour, and will be duplicated when the station is completed. The ropeway is so designed, and such spares are carried, that any breakdown can be dealt with in three hours or less. The bunkers in the boiler-house have a capacity of 50 tons per boiler, or about 25 hours' rated steaming capacity, starting from full bunkers, and assuming all boilers to be in use. Ashes are dealt with by another ropeway. The ash skips are arranged to run suspended from a mono-rail into the boiler-house basement, and immediately under the doors of the ash hoppers. The skips are marshalled at a sort of mono-rail siding outside the boiler-house and go thence to the dumping ground by the aerial ropeway shown with a skip suspended from it in Fig. 1. The ash plant is capable of dealing with 10 tons of ashes per hour.

The Boiler Plant.

The ultimate boiler equipment will consist of sixteen boilers arranged in two boiler-rooms side by side, and having a normal evaporative capacity of 560,000 lb. of steam per hour. At present only one boiler-house is constructed, containing six boilers, four on one side of the firing aisle and two on the other. In view of the tendency of modern design, the practice adopted at Padiham cannot fail to cause some surprise, but criticism is silenced by the results obtained. The boilers are of the old Babcock and Wilcox land type, each with three longitudinal drums. They are thus similar to those used at Radcliffe, although the type has been almost entirely discarded in other power stations in place of the more highly rated cross-drum marine pattern. The working pressure is no higher than 250 lb. per square inch, and the temperature of the steam at the superheater outlet does not exceed about 620 deg. Fah. The heating surface of each boiler is 9273 square feet, and the rated capacity is 35,000 lb. per hour. It will be seen that a rating of less than 3·8 lb. of steam per square foot has been adopted, a recognition of the fact, too often ignored, that easy steaming tends to efficient operation. The boilers are set in brickwork without steel casings, another tribute to the merits of former practice, and each is provided with a cast iron economiser of Green's patented Ringstay type, having a surface of approximately half the heating surface of the boiler. The economisers are set on the firing floor level behind their respective boilers. Each boiler is fired by a pair of chain grates of Babcock and Wilcox type, aggregating 240 square feet of active surface. Natural draught suffices for ordinary conditions of working, a steel chimney serving two boilers and producing a draught of 0·4in. at the dampers. An induced draught fan giving a draught up to 1in. w.g. is, however, provided at the base of each stack. These fans are used merely as a standby, to enable the boilers to be forced or to permit the burning of low-grade fuel.

The very great care given to the design of the boiler-house has been amply justified by the results. Fig. No. I. in our Supplement, a view of the firing aisle, and Fig. No. II., a view of the end of the boiler-house with the boilers on the right and the feed pumps against the engine-room wall on the left, show a natural illumination which has probably never been surpassed in any double-sided boiler-house with overhead bunkers. We, indeed, question very much whether it has ever been equalled. Under such conditions of lighting, it is a pleasure to operate a plant, and both safety and efficiency are certainly enhanced. Fig. No. III. is from a photograph taken on the steam pipe operating gallery immediately above the passage shown in Fig. No. II. The good broad gangway, about double the usual width, with hand rails along both sides, and the easy accessibility of the valve wheels will be appreciated. From this gangway access to the boiler tops is given by the short stairway seen on the right. The view presented at the top of the stairs is that given in Fig. No. IV. The settings are flat-topped, the boiler

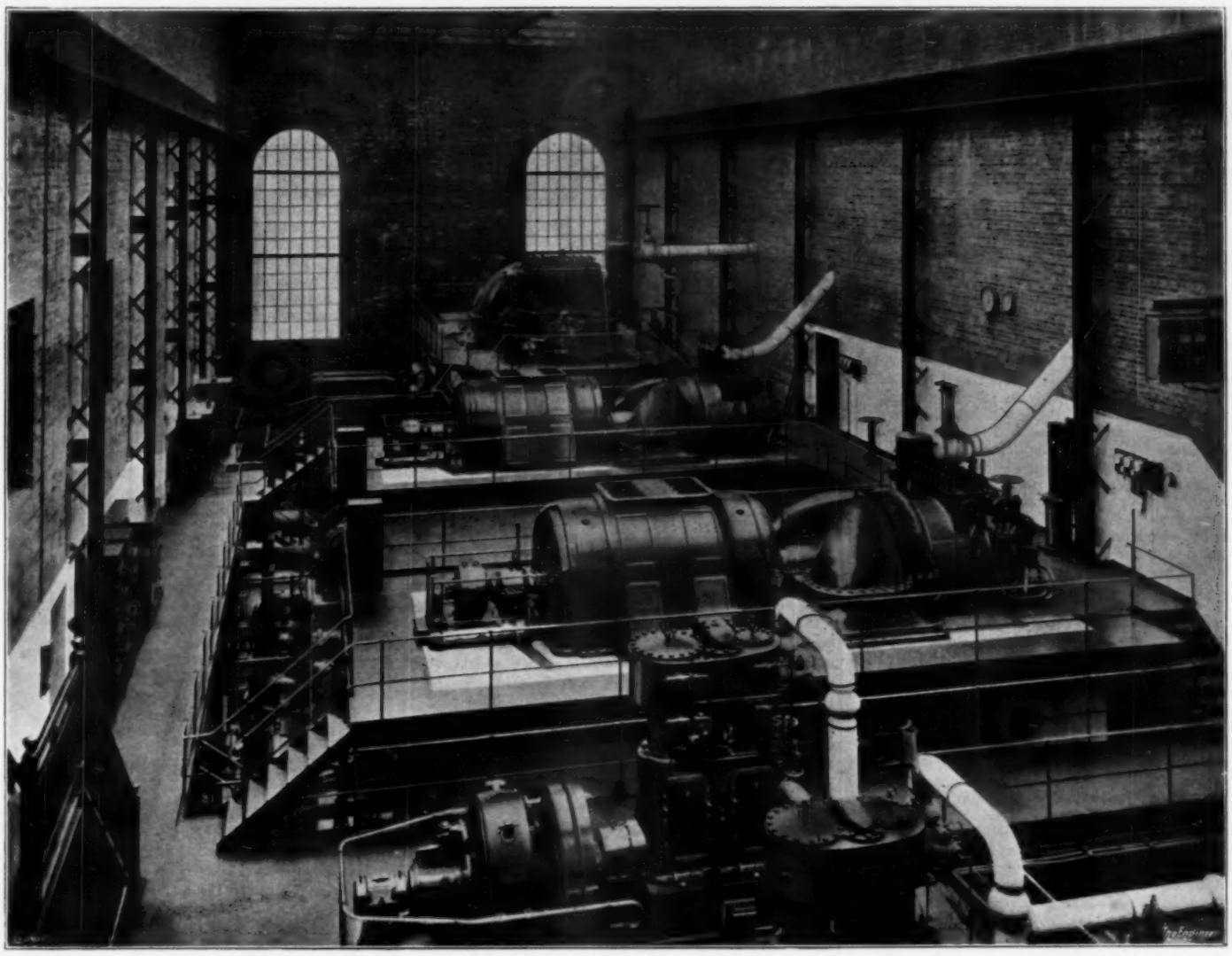

FIG. 3—INTERIOR OF ENGINE ROOM—PADIHAM

drums being visible by opening the doors shown. Once again, the excellent lighting and the ease of access and supervision call for remark. Yet another view of the boiler-house is given in Fig. 2. This shows the economisers with the backs of the boiler settings on the right and the induced fan discharge ducts on the left. Each fan takes the gases from the chimney base and returns them to the stack a little higher up, a damper between the two fan ducts being closed when the fan is in service.

The Engine-room.

The engine-room lies across the end of the boiler-room and at right angles to it. Its present equipment consists of two turbine units, each of 7500 kW maximum continuous rating, and one of 15,625 kW maximum continuous rating. The existing capacity of 30,625 kW will ultimately be increased to 61,875 kW by the addition of two more units. All the turbo-generators have been supplied by the British Thomson-Houston Company, of Rugby, which made the whole of the Radcliffe generating machinery. The machines at Padiham generate current at 11,000 volts, three-phase, 50 cycles, and are built for 70 per cent. power factor. The larger machine runs at 1500 r.p.m. and the two smaller machines at 3000 r.p.m. Their general appearance in the engine-room is shown

in Fig. 3, the large machine at the far end looking unduly small by reason of the perspective of the photograph. The auxiliaries are all perfectly visible from the engine-room floor. The condensing plant is arranged for working either in conjunction with the cooling towers or with syphonic circulation from the river alone. The difference in head on the circulating pumps in the two cases is taken care of by variable-speed motors, though, as has already been mentioned, the cooling towers have never yet been put into service. Each of the 7500-kW units has its own condenser, but the two units share a common auxiliary plant. The auxiliary plant comprises three circulating pumps, each capable of dealing with one-third the water required by the two condensers. This arrangement permits of smaller and more efficient pumps than would otherwise be used, and in the case of the break-down of one circulating pump, there still remain two-thirds of the total pumping power available. Two of the pumps are driven by direct-current motors and the other by a variable-speed alternating-current commutator motor. The whole of the condensing plant at both Radcliffe and Padiham has been supplied by Messrs. Worthington Simpson Ltd.

The air and extraction pumps are arranged in the manner justified by the experience at Radcliffe. There are two pumping units for air and water extraction, each unit being capable of doing 60 per cent. of the load of the two 7500-kW sets running together. Each pumping unit has therefore a capacity of 120 per cent. of the duty required by a single 7500-kW generator. This is the practice followed at Radcliffe. The water and air extraction for the 15,625-kW turbine are taken care of by a pair of pumping units of the same size. One set of pumps is driven by a direct-current motor and the other by an alternating-current motor.

Provision for Security of Supply.

Although Padiham is linked up electrically with both Radcliffe and Barton, and could thus be sure of a supply of current for the needs of the station itself in cases of emergency, provision has been made not only to render a total shut down, humanly speaking, impossible, but also to enable the plant to be restarted in such an event without reference to any external source of light or power. The lighting of the station is normally performed by a direct-current supply, which remains unaffected by any disturbance on the main system. As an alternative to this, lighting may be maintained by a battery which is in constant use for operating the switchgear. The direct-current supply also serves as a standby to the battery in normal circumstances, and thus safeguards the switch-gear operation. The direct-current supply is furnished by three dynamos driven by Allen vertical compound high-speed engines. Two of the sets have a maximum continuous rating of 300 kW at 375 revolutions per minute, and the third is rated at 150 kW at 450 revolutions per minute. The current is generated at 230 volts. In addition to being responsible for the station lighting, these sets provide an alternative power supply for the stokers, each line of grates being driven by a shaft to which a direct-current motor is coupled at one end and an alternating-current motor at the other. Two of the three circulating pumps for the 7500-kW units, one of the circulating pumps for the 15,625-kW unit, and half of the condensate and air extraction pumps depend on the direct-current power supply, as do also the coaling locomotive and the engine-room crane. The alternating-current part of the auxiliary power is derived from the main bus-bars by transformers which reduce the pressure from 11,000 to 430 volts. Besides driving half the condenser auxiliaries and providing an alternative drive for the stokers, alternating-current power is used for one of the 10,000-gallon boiler feed pumps—the other two being steam driven—for the induced draught fans and for the coal and ash-handling plant. A total interruption of either the main alternating-current supply or of the auxiliary direct-current supply would therefore neither leave the station in darkness nor prevent the operation of any apparatus essential to the immediate restoration of the supply.

The Thermal Cycle of the Station.

Steam is delivered to the main range at a gauge pressure of 250 lb. per square inch, and at a temperature of 620 deg. Fah. It expands in the main turbines to a vacuum usually between 29·3in. and 29·4in., in the colder months of the year. The condensate, at a temperature in the neighbourhood of 70 deg. Fah., is raised to about 120 deg. Fah. in a closed heater situated between the boiler feed pumps and the economisers. The heating is effected by exhaust steam at atmospheric pressure, coming from the Allen auxiliary engines which provide the auxiliary direct-current supply, and from the steam-driven boiler feed pumps. The amount of exhaust steam can be varied to suit the quantity of condensate at any time by changing over the auxiliary motors or station lighting from one system to another, or by running either the steam or the motor-driven feed pumps. The steam supply for the Allen reciprocating sets is taken from a separate main in which the temperature of the steam does not exceed about 500 deg. Fah. This steam is obtained by tapping the superheaters at intermediate points. There is no de-aerating plant, the condensate leaving the condensers practically air-free and passing to a covered hotwell from the bottom of which it is drawn by the feed pumps. The hotwell is sealed by steam admitted above the surface of the water and escaping through a small vent hole. As the hotwell is at atmospheric pressure, and its temperature is only about 70 deg., there must, of necessity, be an enormous preponderance of air in the vapour above it. It is found, nevertheless, by daily tests that the free oxygen in the feed does not exceed about 0·15 c.c. per litre a proportion as small as that usually obtained by special de-aerating plant. The explanation no doubt is that the quiescence of the water in the hotwell and the fact of the inlet and outlet both being at the bottom prevent any aeration of the surface layer of water from affecting the main flow through the tank. The make-up water is not obtained by evaporation, for there are no more evaporators than de-aerators in the station. It is obtained from the river and treated first by the lime and soda process, and then by the zeolite process before entering the system. Its ultimate condition is that of zero hardness and slight alkalinity. So thorough is the treatment that blowing down of the boilers only amounts to a few inches per month, and in spite of this they are kept so clean internally that a brushing out once a year is all the cleaning they need. There are indeed no mechanical tube cleaners at all in the station.

(To be continued.)

Dynamic Loading on Locomotive Wheels.

By Professor GEORGE LOMONOSSOFF.

No. I.

It has long been known that the dynamic reaction of a wheel upon a rail differs from the static reaction. Nevertheless, until quite recently it was usual for civil engineers when calculating the strength of bridges and rail tracks, to use only the static value for the wheel loads, which made the results so obtained somewhat open to question. In defence of such a practice the consideration was advanced that our knowledge of the nature of the vertical dynamic reaction Z is at present incomplete, and that the values of this reaction which are obtained when testing bridges contradict the generally understood value of Z. This is due to confusion between the dynamic loading and the dynamic reaction on a bridge. With regard to our knowledge of the magnitude of the dynamic reaction of wheels, the known facts are sufficient for a general understanding of the problem, but are at present somewhat lacking in form and in order. Such a position may be traced to the fact that, during the last eighty years, mechanical engineers have worked more with the idea of reducing these reactions than with the aim of putting them in a form such as might be conveniently employed by civil engineers. This trend of development can be easily traced in the works of the French engineer, Marié,[1] who worked for many years on the problem of the stability of rolling stock, but never touched upon the question of dynamic loading on wheels.

Owing to the existence of such a position, the Russian Rail Commission pointed out, at an Engineering Council held in 1912, the necessity of determining independent values for Z, for varying conditions, on the wheels of Russian locomotives. This task was allotted to the author of this article and a group of his pupils. The problem was attacked by a deducto-inductive method, which method had given good results in other branches of technical science. The method employed was to utilise theory to its fullest extent, and then to supplement it by carefully prepared scientific tests when found to be insufficient.

For this reason the present article begins with a theoretical statement of fundamental facts. One may perhaps apologise for the excessive use of formulæ, but these formulæ have such an unusual importance that they cannot well be omitted. Their importance is due to the use to which they are put, which is not to determine the correct dimensions of locomotive parts, but rather to make a correct determination of Z possible, even with inaccurate measurements of locomotive parts.

Fundamental Equations.

In every problem of railway rolling stock, except that of the locomotive, the wheel load when in motion may be expressed by the following equation—

$$Z = R + p + Z_f,$$

where R is the reaction of the springs, p the weight of the wheel and half the axle, and Z_f the friction between the guide plate and axle-box resolved on to the plane of the wheel. It is evident that—

$$Z_f = \varphi_r X_r$$

where φ_r is the coefficient of friction at that point and X_r the reaction of the axle-box on the guide plate resolved on to the plane of the wheel. On the other hand, owing to the fundamental nature of spring action—

$$R = k f,$$

where k is the coefficient of rigidity of the given spring and its deflection at the given time.

In a state of rest, the static loading is given by the expression—

$$P = k f_\circ + p + \varphi_r X_\circ,$$

where $f_\circ$ is the static deflection of the spring, and $X_\circ$ the static reactions of the axle-box, which, in the absence of a departure from the vertical, equal zero. Hence—

$$Z = P + k (f - f_\circ) + \varphi_r X_r,$$

or, expressing the deflection of the springs by $f - f_\circ = z$, we obtain the equation—

$$Z = P + k z \pm \varphi_r X_r \quad . \quad . \quad . \quad (1)$$

The alternative sign before the last term of this expression is occasioned by the fact that the direction of this force depends on the sign of the differential $\frac{dz}{dt}$, and not that of X.

The formula given above is valid for railway coaches, tenders and other rolling stock of a similar type, but it does not hold for steam locomotives and for Diesel locomotives, which have cylinders of the steam locomotive type, such as those of the Shelest or M.A.N.-Esslingen engines. In such locomotives there are, in addition to the forces acting through the springs, independent centrifugal forces which act on the driving wheels and are caused by additional balance weights and reactions due to the reciprocating parts, including a known portion of the connecting-rod.

It is well known that the balance weights on a locomotive counterbalance not only revolving weight, but also a part of the reciprocating weights of the reciprocating parts which are moved backwards and forwards by the pistons. The actual balance weights attached to the wheels of a locomotive can be replaced in theory by two balance weights :—

(1) Those which counteract the centrifugal forces of the revolving parts.

(2) Those the horizontal component of which counteracts a portion of the reciprocating parts.

The first balance weight which counteracts the revolving masses by its centrifugal force exerts no reaction on the permanent way. The second balance weight, which may be termed "additional," not only brings into existence by its centrifugal force a horizontal force on the wheel, which partially counter-

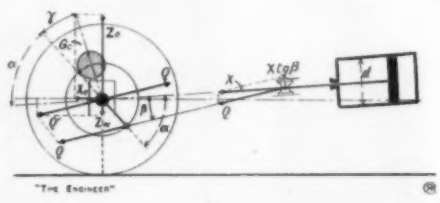

FIG. 1

acts the momentum of the reciprocating parts, but also a vertical force $Z_\circ$—see Fig. 1.

Let us call the weight of the additional balance weight resolved to the plane of the crank web G_e, the angular velocity ω, the crank radius r, the angle swept out by the additional balance weight γ, the angle swept out by the right crank measured from its outer position α, the angle of inclination of the cylinders θ. Then—

$$Z_\circ = \frac{r\,\omega}{g} G_e \sin(\alpha - \theta + \gamma) \quad . \quad . \quad . \quad (2)$$

—see Fig 1.

The fact that under the influence of the additional balance weights, the locomotive wheels are alternately loaded and unloaded, was first established by the experiments of Nollau[2], and is explained with great clearness in the classic works of Clark[3] and Couche[4]. It is usual, however, for formula (2) to be stated in a different form, in which it can be used for correctly calculating the balance weights. The formula, however, as above presented is valid for any balance weight, as long as the values G_e and γ can be determined.

Besides the centrifugal forces of the parts not rotating around their centres of gravity, there are applied to the wheels of the main driving axle other forces resulting directly from the transmission of the pressure of the steam on the piston X. It will be

[1] Marié, "Les dénivellations de la voie et les oscillations du matériels," 1906. Marié, "Les grandes vitesses," 1906. Marié, "Les oscillations du matériel dues au matériel lui meme," 1907. Marié, "Note complémentaire sur les oscillations du matériel," 1907. Marié, "Étude complémentaire sur la stabilitée du matériel," 1909. Marié, "Limites de flexibilité des ressorts," 1910. Marié, "Dénivellations de la voie et oscillations de véhicules," 1911.

[2] *Eisenbahn Zeitung* (Stuttgart), 1848, p. 323.

[3] Clark, "Railway Machinery," 1861, p. 165–179.

[4] Couche, "Voie, matériel roulant, &c.," Vol. II., 1873, p. 399–414.

seen from Fig. 1 that the force at the crosshead can be resolved into two forces, one along the connecting-rod—

$$Q = \frac{X}{\cos \beta}$$

and one at right angles to the slide bars—

$$N = X \tan \beta.$$

The first of these forces is transmitted to the wheels through the cranks, and it can be represented by the couple Q Q rotating the wheels and the force—

$$Q_1 = Q,$$

the second force exerts a vertical reaction on the axle—

$$Z_S = \frac{\sin (\beta + \theta)}{\cos \beta} X$$

or, noting that—

$$r \sin \alpha = L \sin \beta,$$

where L is the length of the connecting-rod—

$$Z_S = X \cos \theta \left(\frac{r}{L} \sin \alpha + \tan \theta \right)$$

for angles of less than 10 deg., the expression may be written—

$$Z_X = \left(\frac{r}{L} \sin \alpha + \tan \theta \right) X \quad . \quad . \quad . \quad (3)$$

In order to be able to use formula (3) in calculations, some expression must be substituted for X. This function is a sum of the steam pressure on the piston and the inertia of the reciprocating masses, *i.e.*, if p_x is the piston steam pressure on the piston at the given time, d the piston diameter, j the projection of its acceleration on the cylinder axis, q_c the sum of the weights of the reciprocating parts, and η_i the mechanical efficiency of the running gear, then—

$$X = \eta_i \left(p_x \frac{\pi d^2}{4} - j \frac{q_c}{g} \right)$$

The function j, as it is known, can be expressed by the formula—

$$j = r \omega^2 \left(\cos \alpha + \frac{r}{L} \cos 2 \alpha \right)$$

therefore—

$$Z_X = Z_P + Z_C,$$

where—

$$Z_P = \eta_i \frac{\pi d^2}{4} p_x \left(\frac{r}{L} \sin \alpha + \tan \theta \right) \quad . \quad . \quad (4)$$

is the result of the action of the steam in the cylinders, and—

$$Z_C = - \eta_i \frac{r \omega^2}{g} q_c \left(\cos \alpha + \frac{r}{L} \cos 2 \alpha \right) \times \left(\frac{r}{L} \sin \alpha + \tan \theta \right) \quad . \quad . \quad . \quad (5)$$

that of the inertia of the reciprocally moving parts.

In formula (4) p_x is the difference of the pressures on the two sides of the piston, and it has a different value for every angle α and is obtained from the indicator diagram. Thus Z_o, Z_p and Z_c are all functions of the crank angle α.

It is, however, the forces Z_x which act on the same plane as the wheels, *i.e.*, at a distance y_o, say, from the longitudinal axis of the locomotive which are of interest to us. And not the forces Z_X acting in the plane of the cylinders a distance y_c from the longitudinal axis of the locomotive.

From the law of moments—

$$Z_X = \frac{y_c + y_o}{2 y_o} Z_X' - \frac{y_c - y_o}{2 y_o} Z_X''$$

where Z_X'' is the force applied from the other end of the locomotive.

Considering now the reactions between the axle-box and the guide plate. On locomotives with a continuous driving force, *i.e.*, on electric locomotives, turbo-locomotives and also Diesel locomotives with electric, hydraulic or gear transmission—

$$X_r = F,$$

where F is the driving force applied to the driving wheel rims. As it is necessary, in order that the wheel should roll and not skid, that F should be $\leq \varphi_o Z$, where φ_o is the coefficient of friction between wheel and rail when in a state of rest. Hence—

$$\varphi_r X_r \leq \varphi_r \varphi_o Z_r \quad . \quad . \quad . \quad . \quad . \quad . \quad (6)$$

Taking the maximum values for φ_r and φ_o namely, 0·2 and 0·25, we find that $\frac{\varphi_r X_r}{Z}$ should be $\leq$ 0·05. Therefore, in locomotives of this type the frictional force in the guide plates cannot be greater than 5 per cent. of Z. It is usually much less, namely, 2 per cent. On locomotives with connecting-rod transmission X_r depends on α and its maximum value in special cases may be as high as 7 per cent. of Z. Usaully, however, it is from 2 to 3 per cent.

From what has been said, it will be seen that the dynamic reaction on the rail of all rolling stock, except electric locomotives with motors at the bottom of the frame, the steam locomotive and the Diesel locomotive with cylinders of the steam locomotive type, is given by the expression—

$$Z = P + k z \pm \varphi_r W \quad . \quad . \quad . \quad . \quad (7)$$

where W is the resistance or the pressure on the given wheel. This is also valid for the carrying axles of a locomotive. For driving axles to which continuous forces are applied—

$$Z = P + k z \pm \varphi_r F \quad . \quad . \quad . \quad (7\ bis)$$

For electric locomotives with low motors, this formula takes the form of—

$$Z = P + k z + Z_m + \varphi_r F \quad . \quad . \quad . \quad (8)$$

where Z_m is the dynamic effect of the oscillation of the motor on its spring.

For locomotives with connecting-rod transmission it becomes necessary to consider seprately the main driving axle, which is acted upon by both the connecting-rods and the coupling-rods, and also the driving axles, which are acted on by the coupling-rods only. For the latter—

$$Z = P + k z \pm \varphi_r X_c + Z_o \quad . \quad . \quad . \quad (9)$$

where Z_o represents the effect of the additional balance weights. For the main driving axle—

$$Z = P + k z \pm \varphi_r X_c + Z_o + Z_p + Z_c \quad . \quad (10)$$

In this equation Z_p and Z_c are resolved on to the plane of the wheels, and they differ from Z_r and Z_C in the same manner as N_o differs from Z_N.

The formula given in equation (10) is the expression which we desired. This expression is made up of six functions, the first of which depends on neither the speed V in kilometres or miles per hour, nor on the angle of rotation of the crank $\alpha = \omega t$, where t is the time. The function z really depends on V and t, but this relation is so complicated by outside forces, such as the friction in the guide plate and springs, the shocks while running, &c., that, as will be shown later, it may be considered independent of V and t. Hence the sum—

$$P + k z = P_z$$

may be considered independent of α and V. The functions Z_o and Z_c are, it is evident, on the contrary, dependent on—

$$V = a D \omega,$$

and on the angle α. The functions Z_p and Z_c depend on the steam pressure P_z corresponding with the given α, *i.e.*, on α and the shape of the indicator diagram. The latter, to a great extent, depends on V^2. Hence, we are right in saying that—

$$Z_a = Z_o + Z_c + Z_p + Z_f = f(\alpha, V).$$

These meanings of the separate functions expressed in formula (10) play as important part in the determination of the maximum and minimum values of Z and for practical purposes, *e.g.*, for calculation of rails and for the determination of the maximum speed allowable for traffic, only these functions are of interest. The maximum and minimum values of $f(\alpha, V)$ are given for definite values of α and V. The maximum and minimum values of P_z, on the other hand, are affected by other causes, chief among which are those arising out of the condition of the permanent way. The probability therefore of the coincidence of the maximum $f(\alpha, V)$ with the maximum P_z and the minimum $f(\alpha, V)$ with the minimum P_2 is not great, but it is a remote possibility, and as such has to be taken into account. For this reason it is advisable to make both rail and sleeper calculations with a value for maximum Z = maximum P_z + maximum $f(\alpha, V)$.

On the other hand, as during the whole period of service of the given sleeper or rail this coincidence of maxima may not occur, it is advisable when making such calculations to take the elastic limit of the material as the highest permissible loading stress.

In the calculation of limiting speed, minimum Z has to be considered. This can never be less than zero, as otherwise the least side shock can cause derailment.

In order to make it possible, however, to use these calculations, it is necessary to know the numerical values of the function in formula (10) for the given type of locomotive. With this object in view, experiments were carried out on the Russian railways. An account of these experiments will be given in the following article.

(To be continued.)

SIXTY YEARS AGO.

IN our issue of July 17th, 1868, we gave some account of the proceedings at a banquet at Willis' Rooms, given to Mr. Cyrus W. Field, of New York, "in recognition of the benefit he has conferred upon mankind by working so earnestly with brain, mind and body to unite the old and new worlds by means of a telegraph wire." In the day of prosperity Mr. Field found no lack of admirers and friends. At one time, however, the Atlantic telegraph seemed to be the dream of a well-meaning maniac. Even the directors of the Atlantic Telegraph Company had turned against Mr. Field for a period, and we alone of the Press claimed to have supported him in his adversity. The banquet, presided over by the Duke of Argyll, was attended by over three hundred gentlemen and many ladies. Among the names of the guests we recorded that of Mr. W. H. Harrison, whom we described as "the reporter turned overboard by Mr. Glass from the Great Eastern in 1865." Tradition has it that Mr. Harrison, defying the contractors' edicts against publicity, shipped as a stoker on the "Great Eastern" in order to report for the benefit of our readers the vessel's first attempt to lay the Atlantic cable. He was discovered, so the story goes, some time after the voyage had started and was unceremoniously placed in one of the ship's boats and allowed to find his own way back to land as best he could. While the banquet to Mr. Field was in progress telegraphic messages were despatched to various people on the other side of the Atlantic, and their replies were read out as they came in. We were careful to give the exact time at which each message was sent and when the reply to it was received in order to demonstrate the rapidity with which the cable enabled communications to be made. The first message was to his Excellency Andrew Johnson, President of the United States. It was sent off from Willis' Rooms at 7.27 p.m. and the reply from Washington was received at 11.23 p.m. The performance in the case of the message sent to, and the reply received from, Lord Monck, Governor-General of Canada, was much better. The message was despatched at 7.34 p.m. and the reply was received at 8.3 p.m. From the Governor of Victoria, Vancouver's Island, the reply was received 1 h. 26 min. after the despatch of the message, but in the case of the Governor-General of Cuba at Havana the interval was 5 h. 29 min. We evidently were not quite satisfied that the messages were being sent direct from the banqueting room, as most of the guests believed. Parts of a Thomson reflecting galvanometer were displayed on the instrument table, but on examination we found that a Morse machine with a Varley key and picker was being used to transmit the messages to Valentia, Ireland, whence they were relayed across the Atlantic. We closed our account of the banquet by stating that "Several actions at law were afloat against the companies or individuals connected with them for alleged infringement of patents and transactions relating to dealings with the newspapers during the cable-laying expeditions."

[5] Clark, "Railway Machinery," 1861, p. 67–68. *Revue Générale*, 1890, Ia, p. 67–68. Strahl, "Einfluss der Steuerung auf die Leistung der Heissdampf-Lokomotiven," 1924, p. 95–100. Lomonossoff, "Lokomotivversuche in Russland," 1926, p. 153–158.

INTERNATIONAL CONGRESS ON BRIDGE AND STRUCTURAL ENGINEERING.

IN connection with the note concerning the second International Congress on Bridge and Structural Engineering to be held in Vienna in September next, which appeared in our issue of June 29th last, the following further particulars have been made public :—

The first two days of the Congress are to be devoted to a general discussion of fundamental problems of steel and reinforced concrete constructions. The remaining two days will be given up to lectures in two separate groups, viz., a steel structures section and a reinforced concrete structures section.

At the meetings on the first two days the problems of items A, B, C—set out below—will be discussed. Papers on the subjects to be discussed will be prepared and will be printed and circulated before the beginning of the Congress to form a basis for discussion, but they will not be read in full. The authors will open the discussion by a brief reference to their papers in order to leave as much time as possible for the discussion. The maximum time allowed for speeches will be ten minutes.

The following subjects are to be discussed at the meetings on the first two days :—

A.—GENERAL PROBLEMS OF STEEL AND REINFORCED CONCRETE STRUCTURES.

1. Architecture of Steel and Reinforced Concrete Bridges. Lecturers : Hartmann, Vienna ; Linton, Stockholm.
2. Effect of Impact of Moving Loads on Bridges. Lecturers : Fuller, U.S.A.; Godard, Paris ; Penna, Madrid ; Streletzky, Moscow.
3. High-grade (Carbon) Steel Structures and Reinforced Concrete Constructions. Lecturers : Bohny, Sterkrade, Germany ; Mendezabal, Madrid ; Saliger, Vienna.
4. Results of Experiments Made to Ascertain the Value of Measurements in Finished Buildings Made of Steel, Concrete and Reinforced Concrete. Lecturer : Bühler, Bern, Switzerland.

B.—STEEL STRUCTURES.

1. Safety and Allowable Stresses. Lecturer : Gehler, Dresden.
2. Buckling of Rods Under Axial and Excentric Forces. Lecturers : Pigeaud, Paris ; Ros, Zürich.
3. Stresses in Rivet Work. Lecturers : Bylander, London ; Findeisen, Dresden ; Gallik, Budapest.

C.—REINFORCED CONCRETE STRUCTURES.

1. Wide Span Arch Bridges. Lecturers : Lossier, Argenteuil, France ; Spangenberg, Munich, Germany.
2. Shearing Resistance of Concrete. Lecturer : Mörsch, Stuttgart, Germany.
3. High-grade Concrete and its Control in the Field. Lecturers : Hübner, Bern, Switzerland ; Kleinlogel, Darmstadt, Germany.
4. Safety of Concrete Against Cracking. Lecturer : Probst, Karlsruhe, Germany.
5. Lateral Rigidity of Open Bridges. Lecturers : Hawranek, Brünn, Czechoslovakia ; Ostenfeld, Copenhagen.

Letters and communications concerning the Congress are to be addressed to the Internationale Tagung für Brücken- und Hochbau, Technische Hochschule, Vienna, IV.

THE Argentine Government proposes to ask Congress for authority to proceed with important extensions at the Port of Santa Fé, on the Santa Fé channel of the Rio Paraná, near the mouth of the Salado, about 480 kiloms.—298 miles—north-west of Buenos Aires. The extensions contemplated will involve an outlay of 5,000,000 paper dollars. To that sum the National Government will contribute an annual payment of 500,000 paper pesos until completion of the works. Santa Fé, a port of call for the smaller river steamers, is connected by a ferry with Paraná, on the opposite bank of the river of the same name ; but the port for larger steamers is at Colastiné, on a deeper channel, 11 kiloms.—7 miles—away, with which it is connected by rail. Santa Fé, which is the centre of a vast grain-growing district, is also directly connected by railway with Rosario, Córdoba, Tucumán and the frontier of the Chaco.

ALFRED DOCK, BIRKENHEAD, NEW RIVER ENTRANCE LOCK

New River Entrance Lock at Birkenhead.

TO-MORROW—Saturday—Lord Derby will perform the official opening of a new 80ft. river entrance lock to the Alfred Dock, Birkenhead. The site of the new lock was formerly occupied by two smaller locks, one 398ft. long by 50ft. wide and the other 198ft. long by 30ft. wide, which were opened in 1866. The length of the new lock is 600ft., and for economy in the use of water when locking small craft this length may be subdivided when required into two compartments, one of 400ft. long and the other 200ft. long. The width of the lock is 80ft. and the entrance from the river Mersey is so formed that vessels entering or leaving will be able to do so without any difficulty. The sill or floor of the lock has been constructed at a depth of 12ft. below Datum, affording a depth of 40ft. 4in. at average high water level of spring tides. The maximum depth hitherto available for vessels entering the Birkenhead Docks was 36ft. 7in., so that, apart from the advantages to be derived from the increase of depth in respect of times for entering and leaving the docks, east-bound vessels can in future be loaded to the maximum draught that can be taken through the Suez Canal, after allowing for the lightening ensuing *en route* from coal consumption, &c. The river bed in the fairway to the lock has been deepened, accordingly, over an area sufficient for all needs.

The equipment includes three pairs of steel gates, each leaf weighing about 210 tons. The gates are operated by hydraulic machinery of modern type, similar to that at the recently completed Gladstone Docks, Liverpool. Gangways for pedestrians have been provided over two sets of gates and there are special sills and quoins, so that in the event of the lock requiring to be dried for repairs the working gates can be reversed and used as dams. Hydraulically operated sluices are installed for controlling the discharge of water into the lock for levelling purposes, the influx being distributed over the whole length of the lock in order to avoid disturbing ships waiting to be locked through. The lighting is electric and the equipment includes beacon lights 90ft. high, which will remove all difficulties attendant on the use of the lock in the dark hours.

The Birkenhead Docks are used almost exclusively by steamers trading with China, India, Japan, and South Africa, and the ss. "Sarpedon," belonging to the Ocean Steamship Company, Ltd., which was built at Birkenhead by Cammell Laird and Co., Ltd., will be the first vessel to pass through the new entrance lock to the river.

An Unusual Flood Water Pumping Operation in Norfolk.

By E. N. GREEN.

THE unwatering of flooded areas by plant of large capacity, but small weight and bulk, capable of being erected rapidly on temporary foundations, is a matter of importance to engineers responsible for the drainage of low-lying agricultural land adjoining rivers. The screw or propeller pump does not appear to have been employed hitherto for such operations, but recent experience has shown this type of pump to be particularly well suited for work of this class, and the description of a typical application may be of technical interest.

The melting of the heavy snow which fell in several parts of the British Isles during the latter part of December, 1927, caused widespread flooding and, in some cases, the bursting of river banks. An instance occurred in the flooding of a large tract of land owing to the failure of the north bank of the river Wissey, near Downham, in Norfolk. This flooding submerged the Fordham and Roxham Fens to a depth of several feet and extended from Denver, across the main road from Ely to King's Lynn, past Hilgay, and up to the Stoke Ferry drainage area.

After the breach in the river bank had been closed, part of the flood water was drained off by gravitation, into the river Ouse, at the western end of the flooded area near Denver Sluice. It was seen, however, that the flood water east of the main road and extending back to Stoke Ferry could not be drained off by natural means in time to permit of cultivation of the land during this season, and it was feared that part of the area might remain flooded throughout the summer.

Various schemes and sites for temporary pumping plant were considered by the local authorities, and it was eventually decided, about the middle of February, to instal a 21in. "Gill" axial flow pump, discharging into the river Wissey, on the east side of the main road. The scheme also included the provision of a second "Gill" pump to be placed as a "stand-by" at the western limit of the flooded area, near Denver Sluice, in case the normal means of draining this lower or Fordham Fen area, of about 500 acres, failed to dispose of the water within the limit of time available.

By permission of the Ouse Drainage Board, the first of these pumps were installed during the early days of March, at a site about 300 yards to the east of Hilgay Bridge, on the north bank of the Wissey, to pump from the flooded Roxham Fen or Eastern area covering about 640 acres and containing somewhat over one million tons of flood water, supplemented by about 6000 tons of water per day draining from the upper part of the valley near Stoke Ferry.

These eastern and western areas were divided by the main road embankment, and during the first two days of the pumping operations the culvert sluice through this embankment was left open. It was then closed to allow of the smaller western area, of some 500 acres, being drained by gravitation and by the existing catch-water pumping station, whilst the larger eastern area was left to be unwatered by the "Gill" pump.

This machine consists of a shrouded screw rotor with broad "sickle" shaped blades mounted on a vertical spindle and operating between inlet and outlet guide vanes in a casing of nozzle shape—see Figs. 1 and 2. The pump is made of bronze, with a cast iron casing, and weighs complete less than 7 cwt. It is mounted vertically on the lower end of a flanged "rising main" of mild steel plating, 6ft. in length, which is, in turn, supported from a mild steel bed-plate carrying a 90 deg. discharge bend of the same material. The plant, it may be explained, was hurriedly put together from component parts, which happened to be to hand, and was not specially constructed for the work. The vertical shaft, or spindle, of the pump is in three sections, one in the pump proper, one in the rising main, and one in the discharge bend, these shaft sections being coupled together by mild steel muff couplings with cotters, and each having a bearing carried in its respective part of the machine. The upper bearing, which comes outside the pump pipe above the discharge bend, consists of a heavy ball thrust and radial bearing of "Hoffman" design.

In the construction described, the pump assembly is thus separable for transport, into three components, each complete in itself, and each of approximately the same weight, the whole machine weighing about 1 ton. For its capacity it is claimed to be the lightest and most portable pump ever designed.

The upper end of the pump spindle carries a wide face crowned pulley with a single flange, partly encased by a light steel plate hood mounted on the yoke piece which supports the ball thrust and radial bearings.

This type of pump has the peculiar characteristic, at uniform revolution speeds, of absorbing its lowest power when discharging a maximum quantity against a minimum head, and it therefore dispenses with a sluice valve. Moreover, since the pump is submerged, no priming device is necessary.

Belt drive was selected for the installation now being

described, to save time in construction and to facilitate erection on temporary timber foundations by unskilled labour. The supporting platform—see Fig. 1—for the pump was framed up with 10in. by 6in. timbers over a forebay which had its sides sheet-piled with 1½in. planks and its bottom lined with scrap iron sheets, to prevent erosion of the river bank. A parallel channel with sloping sides was cut from the flooded area to the sump of the forebay, and a grating of vertical screen bars was placed across its inner end. The discharge from the pump was through a wooden partition, fitted around the horizontal leg of the outlet bend and forming the closed end of a horizontal wooden trough 3½ft. wide and 3ft. deep, sunk into a trench cut across the top of the river bank. At the open outlet end of this discharge trough a planked shoot was fixed on the river bank, to obviate scour.

The power plant originally employed consisted of a petrol-driven "Caterpillar" type ploughing tractor, rated at 35 B.H.P. for 1000 r.p.m., driving with open belt on to a countershaft, and thence by half-crossed belt to the pump pulley. This arrangement was not very satisfactory, owing to the tractor engine being in bad condition and to the difficulty of maintaining the alignment and tension of the belts with both tractor and countershaft supported on the soft peaty ground of the river bank. The pumping had to be carried on both day and night, and in thirteen days running the tractor used 585 gallons of petrol and 21 gallons of lubricating oil. This gives an equivalent consumption of 1·88 gallons of petrol per hour, including time of stops for engine repairs and belt adjustments. A change of engines being deemed advisable, advantage was taken of an offer from the builders of the McLaren-Benz-Diesel engine to instal a 60 H.P. engine of this type, for, though required to work only at three-quarter speed and below half power, to meet the actual requirements of the pumping, it was believed that considerable economy would result.

This engine, though a full Diesel of solid injection type and four-cylinder pattern, weighs only 1700 lb. It was erected on two longitudinal 14in. by 14in. by 24ft. balks of timber, lent by the Ouse Drainage Board, laid across the discharge trough and seated on four 6in. by 6in. cross timbers bedded into the top of the river bank. Two screw jacks were fitted between the main engine bearers and strong posts sunk into the bank, to traverse the engine and its bearers bodily sideways, for adjusting the tension of the 7in. six-ply Balata belt that was fitted, half crossed, to transmit the power direct from a pulley on an extension of the engine shaft, to the pump spindle pulley. This arrangement proved to be very satisfactory in all respects. In ten days pumping with the original power plant, the level of the flood water was only reduced by 5¾in., whereas, in the subsequent ten days, with the new power plant the flood water level was reduced by 21in.

During the course of the pumping operations it was found necessary on one occasion to dam off the inlet channel by means of stop planks, for the purpose of clearing some obstructions from the sump. While the clearing was in progress the pump was left running slowly and a phenomenon was observed which is peculiar to this type of pump. Having sucked the water down to inlet level and while drawing air, the pump was found to be sustaining a full column of water in the discharge pipe and to be passing into the discharge trough the small trickle of water that found its way past the stop planks.

During the last day of the pumping the level of the remaining flood water was reduced very rapidly, the lift increasing by 8in. in twenty-three hours with the pump speed throttled down to 514 r.p.m. Two hours before the completion of the pumping it was observed that the pump was discharging 33·6 tons per minute against 8ft. 3in. static lift, at this reduced speed.

The quantity of water delivered by the pump was measured in the inflow channel, as the provision of an accurate weir measuring device on the discharge side would have caused delay and involved expense. The inflow channel was cut in hard ground and was some 40ft. in length. It was quite straight and was aligned at right angles to the river bank. Its sides were trimmed to a slope of 40 deg. and a truly parallel section of the channel, level at the grating bars of forebay showed as much as 4in. difference of level. All the head measurements given are therefore conservative, to an increasing degree as the work proceeded.

It is believed that a high degree of accuracy was obtained in the flow measurements, and some instructive experiments were also made on the incidence of flow velocities in the intake channel entrance length. Under certain conditions of approach of the flood water it was observed that at one point within the entrance length of channel the float remained stationary for from 3 to 4 minutes. This was improved by rounding back the corners of the intake cutting from the flood water, but the effect even of a tree standing in the flood water near to the inlet was noticeable in the incidence of flow velocities. The well marked differences between flow velocity lines in the channel were evidently dependent upon the actual direction of approach of the main body of the water, which in turn depended upon the slow but steady east to west movement of the water from the higher ground, also upon the direction of the wind, for, with a north-west wind of certain strength, the flow was evenly distributed over the whole width of the channel entrance. During the latter part of the pumping operations the flow speed in the inlet channel entrance length became too high to enable the flow lines to be explored accurately, as was possible in the earlier stages of the work.

The screen bars placed in the forebay, in front of the sump, were found to obstruct the flow as the speed of the water increased toward the close of the operations, causing the water to cascade into the sump. These bars were therefore moved back along the channel through a distance of 5ft., though even at that distance they were found eventually, with further increase in the flow speed, to cause the water to flow under the intake bellmouth of the pump, in two waves, resembling the bow waves of a ship. In the final stages of the pumping the screen bars were, therefore, moved back some 40ft. to the entrance of the inflow channel.

Throughout the whole of the period of twenty-three days that elapsed between the beginning and the end of the pumping operations, the pump ran without the slightest hitch or trouble, notwithstanding the quantity of foreign matter that could be seen, and heard, passing through it, especially towards the end of the pumping period. After the McLaren-Benz engine was installed the run was practically a non-stop performance, except for attending to and changing a driving belt that had been damaged by being accidentally drenched with oil.

The economy in fuel consumption while running, even on the light load imposed, was remarkable, this consumption being only 307 gallons (2690 lb.) of Diesel fuel oil for working 9¼ days of twenty-four hours.

The following analysis of the cost of operating the plant when driven by the McLaren-Benz engine was made over a period of 219 working hours. The fuel used was the Anglo-American Oil Company's "Light Diesel oil." Stated specific gravity, 0·877; stated calorific value, 19,300 B.Th.U.'s per pound; cost of 2690 lb. fuel oil, £8 10s., or 0·76d. per pound.; fuel consumption for 219 hours or 9·125 days of 24 hours = 2690 ÷ 9·125 = 295 lb. per day, or 295 by 0·76 = 224d., or 18s. 8d. per day. The lubricating oil used was "Redwood No. 1" heavy engine lubricating oil, at £1 17s. 6d. for a 10-gallon drum, or 3s. 9d. per gallon. Of this oil 9¼ gallons were used for engine and pump in the 9·125 days of twenty-four hours, equal to 1·04 gallons, costing 46·8d. per day. For cleaning and starting the engine, 7½ gallons of paraffin at 10d. per gallon were used during the same period, making the cost of this item 8·2d. per day.

Summarising these items, the cost of consumable stores per day of twenty-four hours, worked out as follows:—

	Pence.
Fuel oil	224
Lubricating oil	46·8
Paraffin	8·2
Total	279·0

representing £1 3s. 3d. per day of twenty-four hours, or 11·6d. per hour, as the net cost of running the plant.

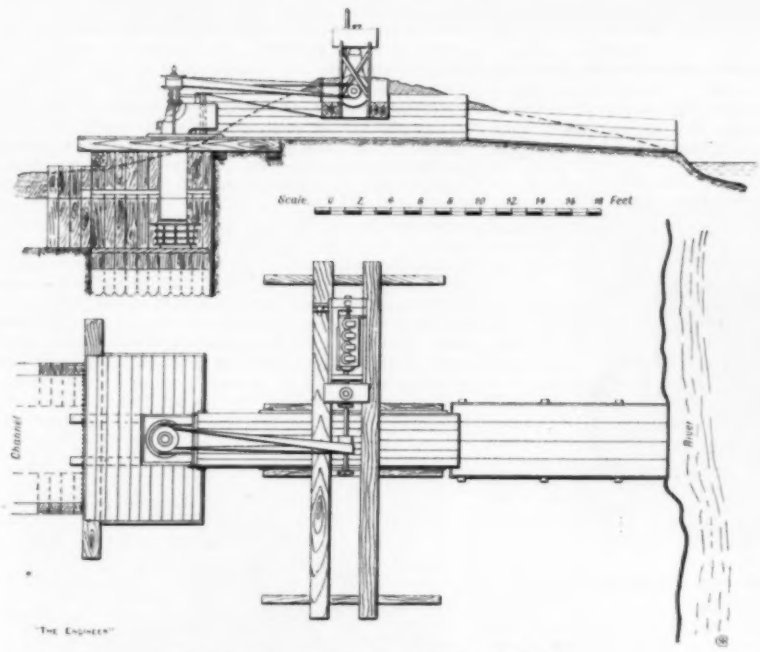

FIG. 1 ARRANGEMENT OF PUMPING PLANT

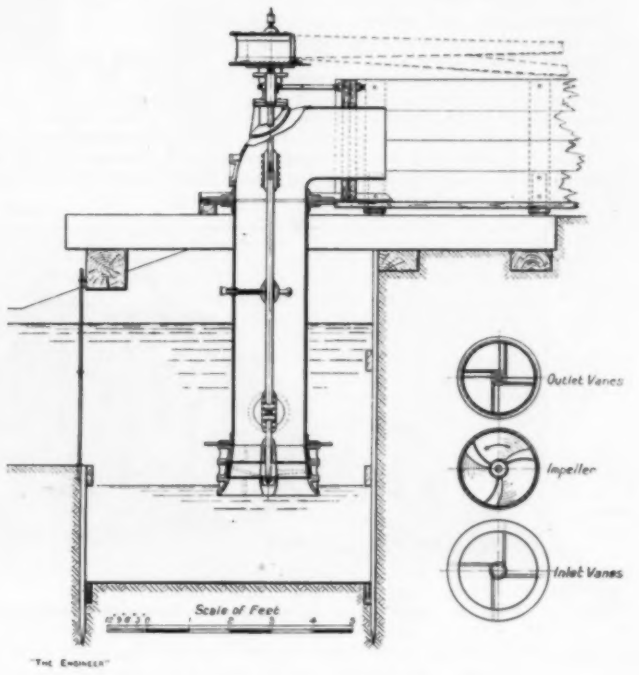

FIG. 2—SECTIONS THROUGH PUMP

Taking an average of the actual lift and output from the pump, the net mean duty during the same period of 9·125 days was 34·75 tons per minute to 7·13ft. lift, which is equivalent to 247·5 foot-tons per minute, or, say, 356,000 foot-tons per day of twenty-four hours. Dividing this figure by the 279d. net cost per day, as noted above, the cost of pumping is found to be 1275 foot-tons for 1d. Analysed on the basis of fuel consumed, namely, 2690 lb. of fuel for 219 hours running, the consumption arrived at is ·205 lb. of fuel per minute, whilst this figure, taken in conjunction with the 247·5 foot-tons per minute net work done by the pump, shows 247·5/0·205 = 1210 ft.-tons per pound of fuel. Converting this into British Thermal Units, the figure arrived at is $\frac{1210 \times 2240}{777 \cdot 6} = 3490$ B.Th.U.'s per pound of fuel. And taking the calorific value of the fuel at 19,300 B.Th.U.'s per pound, as stated by the suppliers, the overall efficiency reckoned on the net output of pump, as against the calorific value of the fuel, is shown to be 3490 ÷ 19,300 = 18·1 per cent.

This must be regarded as an exceptionally good result in economy of working, especially for a temporary plant operating under emergency conditions, including, as it does, all the losses incidental upon converting the total energy in the fuel into net work performed.

Date.	Channel area in sq. ft.	Speed of flow in f.p.s.	Discharge. c.f.s.	Discharge. t.p.m.	Pump speed, r.p.m.	Net lift, ft. in.
Mar. 20	16·45	1·22	20·1	34	532	6 5¼
,, 21	15·8	1·265	20	33·8	557	6 7
,, 22	—	—	—	—	—	—
,, 23	14·7	1·333	19·6	33·2	565	6 9
,, 24	12·8	1·571	20·15	34	557	6 10½
,, 25	11·4	1·785	20	33·8	557	7 0½
,, 26	11·0	2·02	22·2	37·6	600	7 2½
,, 27	9·72	2·25	21·9	37	557	7 5
,, 28	8·97	2·38	21·35	36·1	557	7 7
,, 29	8·25	2·41	19·88	33·6	514	8 3

The table above shows the average results of sets

of observations recorded during the last ten days of the pumping operations; the quantities being given in both cubic foot seconds and tons per minute.

On March 22nd the continuity of the observations was interefered with owing to the transmission belt being accidentally damaged by oil and by the time occupied in obtaining and fitting another belt.

In conclusion, the author desires to acknowledge the co-operation of the staff of Gill Propeller Company, Ltd., in designing and assembling the pump and the assistance rendered by Mr. R. F. C. Robinson and Mr. F. L. Yearron during the erection and operation of the plant.

The Royal Show at Nottingham.

No. III.*

WE continue below our review of the exhibits at the Royal Agricultural Society's Show which was held at Nottingham last week.

R. A. LISTER AND CO., LTD.

Special attention was drawn to the fact that all engines shown by R. A. Lister and Co., Ltd., Dursley, were fitted with the patented Ricardo detachable cylinder head. By standardising on these heads, this firm claims to have obtained a remarkable horse-power increase with an absolute minimum fuel consumption—a factor of great importance in these days of fuel taxation. An important addition to the firm's range of electric house lighting sets is a 600-watt direct-coupled plant, specially built to meet the need of the small farmhouse or bungalow.

RANSOMES, SIMS AND JEFFERIES, LTD.

Ransomes, Sims and Jefferies, Ltd., Ipswich, had two stands, one for agricultural implements and the other for lawn mowers. On the former were shown traction engines, thrashing machines, ploughs and an electrical exhibit, comprising a new model induction motor of 2½ horse-power, specially designed for agricultural purposes. This is of the squirrel-cage pattern and is mounted on a carriage for ease of transport. There are also three other types of electric motors for both alternating and direct-current operation. For some time Messrs. Ransomes, Sims and Jefferies have specialised in implements designed for tractor work, and this year they were exhibiting a new "Weetrac" plough, which was coupled direct to a Fordson tractor. A view of this plough, which was entered for the Society's Silver Medals, is given in Fig. 22. It is fitted with "Kristeel" breasts and the implement is manipulated makes it particularly useful in small fields, for it is of the self-lift type, actuated by a single cord, which, like the screw depth adjustment, is easily operated by the tractor driver while seated. It is adjustable for turning furrows from 8in. to 11in. wide, and from 3in. to 10in. deep, and is supplied with either general purpose or digging bodies fitted with "Kristeel" breasts.

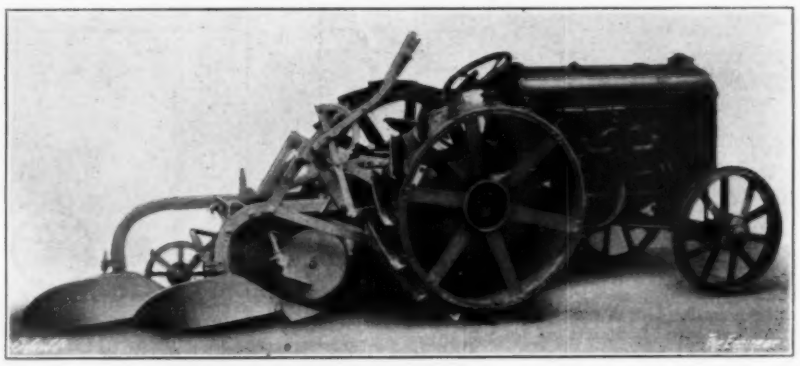

FIG. 22—"WEETRAC" PLOUGH AND TRACTOR—RANSOMES, SIMS AND JEFFERIES

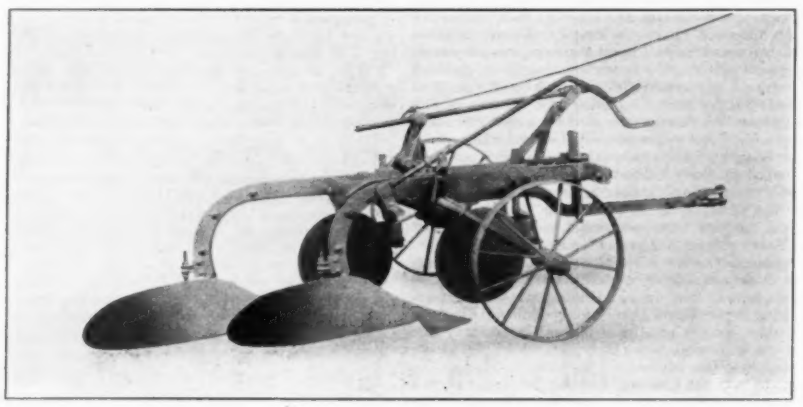

FIG. 23—"MOTRAC" PLOUGH—RANSOMES, SIMS AND JEFFERIES

swivel disc coulters. Another new plough, called the "Motrac," was shown—Fig. 23. This plough is intended for attaching to any tractor. For lightness and strength, high-carbon steel is chiefly employed in the construction of this new two-furrow plough for use with all types of tractors. The ease with which

* No. II. appeared July 13th.

PETTERS, LTD.

Prominent amongst an extensive display of petrol and paraffin engines by Petters, Ltd., of Yeovil, was a 60 brake horse-power, two-cylinder, surface-ignition oil engine, which was shown for the first time. This engine is one of a series which is actually a continuation of this firm's S type series. The manufacture of these engines was discontinued some three or four years ago, but has been taken up again. Certain minor modifications have been introduced into the design, and starting is effected by the Petter cold starter. As many of our readers are already aware, the S type or surface ignition engines were formerly known as semi-Diesel engines, because the principle on which they operated was a compromise between the original low-compression engine and the high compression of the Diesel engine. The term "semi-Diesel" was not considered satisfactory, and was discarded in favour of "surface or hot-bulb ignition," as denoting the principle under which the ignition of the explosive mixture is obtained after starting from the heat of a small hot surface. Although Messrs. Petter admit that engines operating on the Diesel principle may be slightly more economical in fuel, they consider that their additional complication requires greater care and more skilful operation. This attribute is of no particular consequence in the case of larger-size engines, but in the smaller sizes such as we are dealing with, it is a disadvantage. The S type engines operate on the two-stroke cycle, and will run on a wide range of fuel oils. The Petter cartridge used for starting purposes is now well known. There are no valves and valve-operating mechanism, so that the number of moving parts is reduced to a minimum. The enclosed design protects the engine parts from dust, &c. The engines are fitted with a patented shaft governor by means of which it is claimed that perfect combustion of the charge is obtained without external heat of any kind. This governor controls the length of stroke of the fuel pump plunger in proportion to the load, and also advances the period of injection of fuel as the load on the engine decreases. A view of the 60 brake horse-power engine which was shown at Nottingham is given in Fig. 24.

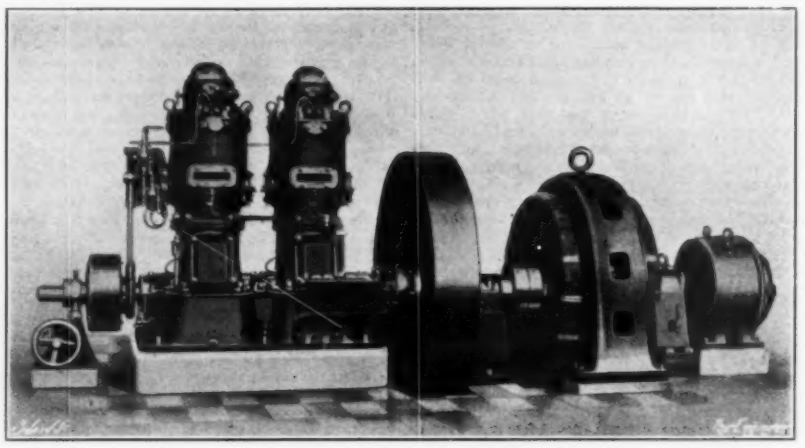

FIG. 24—60 B.H.P. PARAFFIN ENGINE—PETTERS

J. AND E. HALL, LTD.

Refrigeration is a subject which is very much to the fore at the present time, owing to the Government's new regulations with regard to the prevention of the use of preservatives in foods. J. and E. Hall, Ltd., Dartford, had an extensive exhibit of cooling and refrigerating plant for milk in both large and small quantities.

The working exhibit comprised the "Hallmark" automatic refrigerating machine, in conjunction with a Lumley ice cream freezer, and was of special interest. It was an automatic refrigerator which finds its chief application in cooling ordinary cold chambers up to a capacity of 330 cubic feet. As will be seen from the illustration, Fig. 25, the apparatus consists of a single-acting methyl chloride twin-cylinder compressor, with a cast iron base chamber and separate cylinder casting. The valves are of the disc type and the whole of the motion work is enclosed within the crank case, being automatically lubricated. The crank shaft, which is of mild steel, runs in ball bearings, and passes through a gland of the rotary type fitted with a seal ring. The compressor is driven through a V-type belt by a ¾ brake horse-power electric motor. The condenser, which is of the shell pattern, comprises a coil of solid drawn copper tube contained in a cylindrical casting, the methyl chloride passing through the casing and the condensing water through the coil. The units are mounted on a cast iron base-plate, and there are arrangements for belt adjustment. The cooling units consist of copper coils soldered throughout their length to galvanised steel plates. These are secured to the walls of the chamber, and are provided with drip trays to collect the moisture. A thermostat, which is adjustable for different temperatures, is fitted in the chamber operating a control switch for starting and stopping the motor. An automatic valve turns the water on and off as required, and an automatic regulator

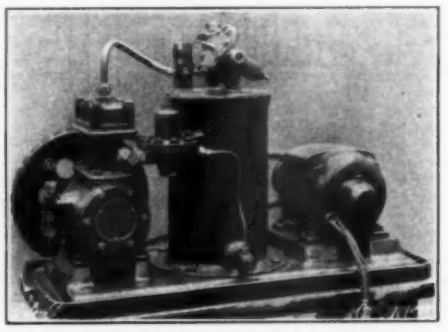

FIG. 25—"HALLMARK" REFRIGERATING MACHINE

controls the refrigerating effect. A safety device to stop the machine in the event of the water failing is also provided.

AVELING AND PORTER.

The adaptation of the crude oil engine to a road roller was demonstrated by Aveling and Porter, Ltd., Rochester. Amongst this company's exhibits was the new 4-ton roller—illustrated in Fig. 26. The prime mover is a single-cylinder four-stroke heavy oil engine of the horizontal pattern, all the working parts of which are enclosed. It is fitted with a governor which regulates the supply of oil flowing to the combustion chamber, and is furnished with self-starting mechanism in which the supply of compressed air is automatically maintained while the engine is at work; the full pressure being thus always available, no auxiliary fuel is necessary for starting up, neither is a lamp required. The fuel injection appliances are very simple. Two road speeds are provided, and the clutch for engaging and disengaging the gears is adjustable. One lever only is employed for starting, reversing or stopping the roller. The road wheels are of the cast steel single-unit type of a diameter and width for use on "Laterite" and similar road materials as well as for ordinary earth roads. Aveling and Porter, Ltd., also showed one of their "One Bag" concrete mixers, an illustration of which is given in Fig. 27. This machine is of the tilting drum type, with a wet batch rating of 6 cubic feet, the drum and hopper being of ample size to take 9 cubic feet of dry materials. The engine is of the two-cylinder pattern, and develops 9 horse-power. The road wheels are of large diameter, built up from pressed steel discs and mounted on pivoted stub axles with gun-metal bushes. With this machine no gauge boxes are required, the cement being introduced direct from the bag, and both sand and aggregate are tipped straight into the hopper, which acts as an accurate gauge box. The relative proportions of sand and aggregate are adjusted by means of a vertical movable partition. An automatic batch water tank is fitted to the machine, and it can be set to deliver any definite quantity of water to the mixing drum. So long as the setting of the batch tank lever remains unaltered the tank will deliver the same amount of water to each batch. The engine is designed for use with either petrol or paraffin, and can be readily restarted without emptying the drum. The hopper is elevated by means of a gear driven winch, and controlled by a Ferodo-lined brake, provision being made for automatic knock-off when the hopper reaches its maximum height of 50 deg. The overall height of the machine is 10ft. 6in., length, 8ft. 3in.; width, 6ft. 9in.; and the net weight 3 tons 5 cwt.

FIG. 26—4 TON CRUDE OIL ROAD_ROLLER—AVELING AND PORTER

FIG. 27 "ONE BAG" CONCRETE MIXER—AVELING

NICHOLSON AND SONS, LTD.

Entered for the Society's silver medals, W. N. Nicholson and Sons, Ltd., Newark, had two new farm implements. One was a self-acting horse rake, in which the rake is controlled entirely by one foot pedal, no hand levers being required, thus leaving the operator's hands free for driving. This is a simple machine, and it has the merit of being "foolproof." The other machine was a combined side-delivery rake, tedder and swath turner, which overcomes the difficulty of turning heavy and tangled swaths. The gear-box contains a simple two-speed reverse gear, providing a slow forward motion for raking and front action swath turning, and a quicker backward motion for tedding and back action swath turning. The rake bars are fitted with reversible curved tines, which can be set to point correctly for either backward or forward motion.

MONEL-WEIR, LTD.

Much attention is being paid to the question of cleanliness of foods and especially of milk at the present time, and on that account the exhibits of Monel-Weir, Ltd., Cathcart, Glasgow, which has taken over the business of the Monel metal department of G. and J. Weir, Ltd., call for more than casual attention. The object of the exhibitors was to put before dairy engineers and dairy equipment manufacturers the advantages which pure nickel and Monel metal offer for the construction of dairy appliances. For such purposes a material which is hard, rustless and is capable of resisting alkaline and acid corrosion is required. It is claimed that no metal complies so fully with those requirements as pure nickel, and the Monel Weir Company was exhibiting a 350-gallon nickel lined vertical coiled Pasteuriser and a sanitary milk filter made of nickel, as well as large size pure-nickel sheets of thin gauge. The vertical coil type of Pasteuriser is a late development in this class of appliance. In the older type with the horizontal coil the coil ends passed through the tank walls below the level of the milk, thus necessitating elaborate packing glands to prevent leakage. These glands are difficult to clean, and rapidly become unhygienic. With the vertical coil as shown in the sketch—Fig. 28—this disadvantage is obviated, as the gland is above the level of the milk in the container. There was shown on this firm's stand a milking machine made by the Vaccar Company, the pails of which were of Monel metal, and a machine built by Ferns Emulsifiers, Ltd., London, in which the parts of the emulsifying bowl were of Monel metal, while the tank and bowl chambers were of pure nickel. It is hoped that the British manufacturers of dairy plant will adopt pure nickel in their construction to a greater extent than hey have done hitherto.

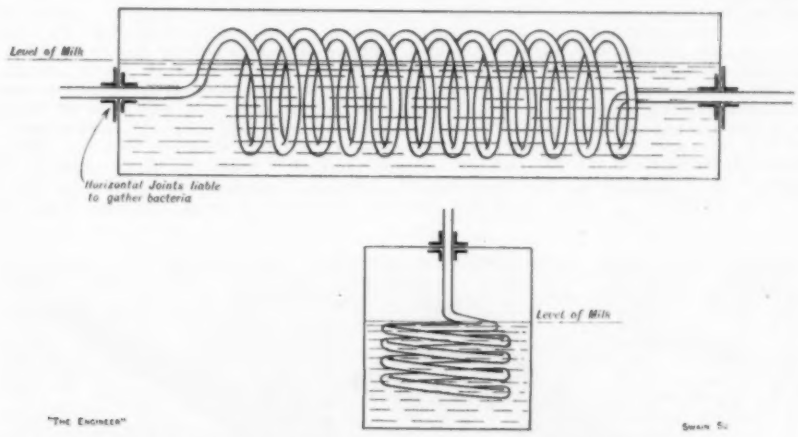

FIG. 28—HORIZONTAL AND VERTICAL PASTEURISERS—MONEL-WEIR

DAVEY, PAXMAN AND CO., LTD.

Davey, Paxman and Co., Ltd., Colchester, were exhibiting in motion 25/29 B.H.P. single-cylinder and 120/138 B.H.P. three-cylinder vertical crude oil engines. Both engines are built on the well-known Paxman principle of unit cylinders and ventilated crank cases. They embody the "spring injection" system of fuel injection and the Paxman-Lentz type of valve gear, which has already been described in our columns. The "spring-injection" system consists of a governor-controlled low-pressure measuring pump which delivers the fuel to a self-contained unit bolted to the head of the cylinder. This unit, styled the injector block, is a combined loader and atomising device and is the only part of the fuel system under pressure. It enables the injection to take place at the same pressure and at exactly the right moment, whatever the speed of the engine, and at the same time avoids the necessity for either an air compressor or high-pressure fuel pump and long pipe connections under pressure. The valve gear, which is operated by an excentric, is continuously lubricated and is silent in action. While enabling use to be made of the very quickest lifts of the valve, it is yet claimed to prevent any possibility of shock, thus lengthening the useful period of service before it needs to be re-ground. The construction of the gear is such that removal of the valve is a matter of a few moments only, there being no cotters or powerful springs to contend with. Reseating the valve is also an extremely simple matter, and correct adjustment can be instantly obtained. The governor is of the spring-loaded type, very sensitive, and capable of adjustment while the engine is running. The fuel consumptions are guaranteed at 0·4 lb. per B.H.P. per hour on all but the smaller sizes, and the makers state that that figure is maintained even at three-quarter load. The lubricating oil consumption, too, is exceedingly low.

ROBEY AND CO., LTD.

Four new types of motor rollers were, in addition to a tandem steam roller, shown by Robey and Co., Ltd., of Lincoln. Amongst the internal combustion engine rollers was a 10-ton three-wheel petrol-paraffin machine, the engine of which is capable of developing 40 B.H.P. on petrol and 32 B.H.P. on paraffin. The engine is water cooled, and is fitted with the Ricardo turbulating head. Two road speeds are provided, viz., 2 and 4 miles per hour, forward or reverse. The clutch is of the double-cone type, and it gives the quick reverse, which is so important when working on modern road materials, its action being practically instantaneous, as no change of gear is necessary. The compensating gear is of very sturdy construction, and all the gears are contained in an oil-tight casing. The rolls are specially wide, and give a total rolling width of 6ft. 4in., and have been given a large overlap, so as to reduce to a minimum the possibility of ridging. A three-tine scarifier, so arranged that no parts project beyond the outer edge of the roller, can be fitted. A general-purpose three-wheel steam roller of the compound type is made of varying weights from 8 to 12 tons, and has new features. The boiler is of the locomotive pattern with a circular fire-box, but in place of the side or horn plates usually riveted to the sides of a square box

boiler, a steel casting is fixed to the boiler barrel by means of an angle ring. This casting carries the whole of the bearings and gearing and removes all stress from the fire-box sides. The front head bracket is carried in a similar manner on the smoke-box end of the boiler. The engine unit is of the same type as that adopted on the steam wagon. The working pressure is 250 lb. per square inch, and two speeds are provided, viz., 2 and 4 miles per hour.

Another interesting exhibit of Robeys was a 60 B.H.P. two-cycle cold-starting vertical oil engine—Fig. 29. This engine is the outcome of careful research and experimental work carried on for several years. As will be seen, it is of straightforward design. It has an expansion plate for the cylinder head on similar lines to this firm's horizontal engine, a relief valve and variable ignition. The relief valve is self-regulating, and does not require the use of breaking plates or similar devices. The fuel pump is constructed

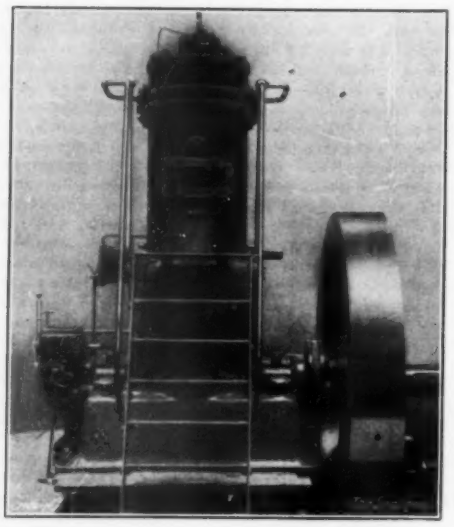

FIG. 29—COLD-START OIL ENGINE—ROBEY

from solid steel, is fitted with a simple plunger arranged with a special outside guide to relieve the plunger of side wear, and is so constructed that any leakage is blown back by compressed air operated by the outside plunger. No packing rings are required. Special double suction and delivery valves are fitted, and each pump is tested, before being fixed to engine, to a pressure of 6000 lb. per square inch. The main piston is made of semi-steel, and has a specially shaped head to prevent abnormal heat reaching the gudgeon pin. The engine is furnished with an automatic air valve, which is mechanically operated by a cam on the crank shaft, so as to ensure positive starting and low consumption of compressed air. The lubrication of the piston is effected by a force-feed pump, driven from the crank shaft, which supplies oil to the large and small end bearings and piston, and all feeds are adjustable by hand. The main bearings are ring-oiled, whilst all moving parts wherever possible work in oil baths. A cast iron heater is fitted to the side of the exhaust pipe with adjustable studs to enable the use of thick oil in cold weather, combined with a filter arranged for easy cleaning. The atomiser is made of steel with a ground plunger valve which has been specially designed to ensure long service, minimum cleaning and perfect cut-off at all loads. The pressure and lift of the valve are adjustable to suit varying qualities of fuel.

HARRISON, MCGREGOR AND CO., LTD.

Amongst the new features in the agricultural implement section should be mentioned one by

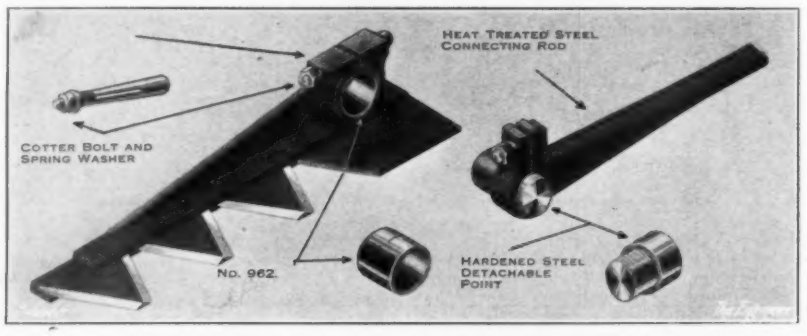

FIG. 30—MOWING MACHINE KNIFE HEAD—HARRISON, MCGREGOR

Harrison, McGregor and Co., Ltd., Leigh, Lancashire, in connection with their mowing machines. It is a split knife head in which is incorporated a case-hardened steel bush held in position by a cotter bolt the bush being easily renewable when necessary—Fig. 30. In association with this is a usual type of connecting-rod with a detachable point instead of the customary solid one. The end of the detachable point and the end of the connecting-rod are screwed, and to hold the point in position the end of the rod is formed with a clip, which is drawn together by a bolt which passes through the ears of the clip at right angles to the longitudinal axis of the point. The makers claim that by the adoption of these improvements the breaking of knives and connecting-rods is reduced to a minimum and also that a considerable saving of time and expense is gained by the user when renewals become necessary. The improvements are patented.

LEYLAND MOTORS, LTD.

Leyland Motors, Ltd., exhibited in the implement section vehicles of interest to farmers and others. Particulars of the vehicles are as follows:—A Trojan three-door model, fitted with drop tailboard to facilitate the carrying of light loads at the rear, when not in use as a pleasure car. Another Trojan exhibit took the form of a light lorry. In the heavier goods class three different types were to be seen, namely, a 4-tonner, a 6-tonner and a Terrier six-wheeler. The two former machines are constructionally very similar. They follow the standard design of the company's heavy goods range, having an engine rated at 34·3 H.P., with a bore 4¼in. and stroke 6in.; bevel type rear axle, &c. On the chassis of the 4-tonner is mounted a hinged-sided body, and the tire

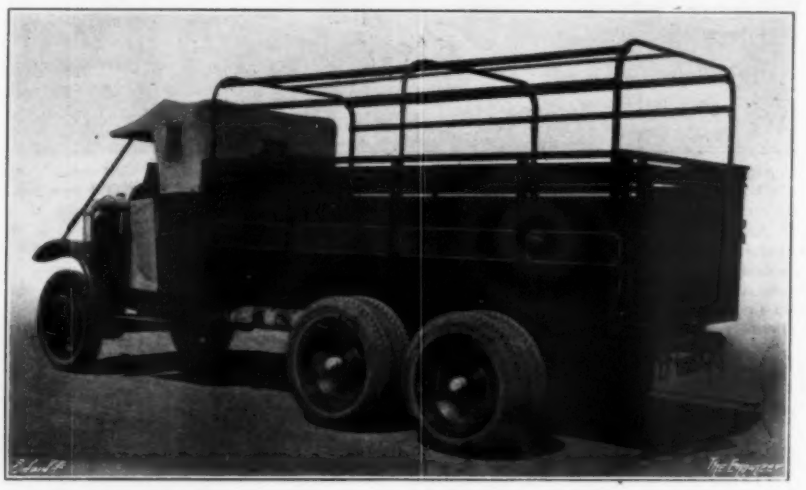

FIG. 31—6-WHEELED SUBSIDY PETROL WAGON—LEYLAND

equipment consists of pneumatics all round. The 6-tonner is mounted on solid tires. The six-wheeler—Fig. 31—follows an entirely new design, and has already received the approval of the War Office as eligible under its subsidy scheme. It is a three-axle vehicle, with a capacity for 4 tons on the road, and over rough or sandy country a load of 3 tons. A total of 8 tons can easily be carried if a trailer is used. The engine has overhead valves and a bore and stroke of 4 3/16 in. by 5½in. respectively developing 80 H.P.; monobloc cylinders, magneto or coil ignition; automatic regulation of oil pressure by throttle position; unit construction gear-box; four speeds forward with an auxiliary gear-box, giving a further reduction of 2·22 to 1 on all speeds; overhead worm drive rear axle with large diameter axle shafts; and 36in. by 6in. pneumatic tires on all six wheels, either single or twin on middle and rear pair of wheels. A portable pump arranged on a two-wheeled trailer on pneumatic tires was also exhibited. The small pump can easily be carried by two persons, and has, we understand, proved itself exceedingly useful and efficient, especially on large estates or with small fire brigades.

J. AND H. MCLAREN, LTD.

Famous for many years as steam engine builders, J. and H. McLaren, Ltd., Leeds, a few years ago took up the construction of internal combustion engines, and entered into an agreement with the firm of Daimler-Benz for the building under licence of the Benz airless injection Diesel engine, which they are applying to cable ploughing, tractors, rail locomotives, and other purposes, as shown at Nottingham. There they had a tractor of 35 B.H.P., with three speeds forward and a reverse, and a motor windlass fitted with a 60–70 B.H.P. Benz engine and 450 yards of rope. This is one of a pair of tackles for ploughing. The windlass consists of a very strong frame of steel channels rigidly stayed, and carried on four steel road wheels, which are so fixed that it gives a three-point suspension, the front wheels being ribbed to give efficient steering, and the hind wheels having cross plates for adhesion. The equipment also includes a set of spudlets for fixing to the driving wheels for extra adhesion when necessary, and angle iron rings for fixing to the front wheels, to ease steerage in soft ground, and to prevent sideslip when travelling over greasy ground. In addition, as an extra, widening rings are supplied of various widths, in order to give larger bearing surface when that is desirable, *e.g.*, when working in sandy, sodden or bog land. The front wheels are guided by a simple chain steerage, worked from the footplate, and the hind wheels are actuated by a worm drive, through differential gear, for facility in turning. The frame carries, at the front end, a four-cylinder lightweight Diesel oil engine, which develops 60–70 B.H.P. at 800 r.p.m. An auxiliary starting engine and gear comprising an air-cooled petrol engine of 4 H.P., with clutch and reduction gear, is fitted to facilitate starting the Diesel engine from cold. A cylindrical fuel tank is mounted on a strong frame in front of the windlass. This tank contains a small compartment at one end to carry paraffin or light Diesel oil, to be used for starting when the engine is working on a heavy fuel, a three-way cock being provided for changing over from one fuel to the other when the engine is in motion. Messrs. McLaren also showed a compound steam ploughing engine, a plough suitable for windlass work, and several sizes of Benz engines.

(To be continued.)

INTERNATIONAL RAILWAY CONFERENCE.

THE questions to be discussed at the eleventh session of the International Railway Congress to be held in Madrid in 1930 are as follows:—I. The use of concrete and reinforced concrete on railways. (A) Investigation into the respective merits of the different designs of concrete sleeper. (B) Concrete and reinforced concrete buildings. II. Resistance of rails against breakage and to wear. (A) First causes of rail breakages. (B) Quality of metal used for rails to give normal wear. (C) The most economical and efficient design of rail joint. III. Investigation into the static and dynamic stresses in railway bridges. IV. Recent improvements in permanent way tools and in the scientific organisation of maintenance work. V. Locomotives of new types; in particular turbine locomotives and internal-combustion motor locomotives. VI. Improvements in the steam locomotive. VII. Electric locomotives for main line traction. VIII. All-steel coaches. IX. Maritime stations. X. Marshalling yards. XI. Signalling. XII. Economical traction. XIII. Competition of road transport. XIV. Mechanical statistical and accountancy work. XV. Co-operation of the staff. XVI. Training of the staff. XVII. Penetration railways. XVIII. Permanent way for light railways. XIX. Electrification of secondary lines. XX. Rail motor vehicles. Sir Henry Fowler, together with Mr. Ellson, the chief engineer of the Southern Railway, are reporters for Great Britain, Dominions and Colonies for III.; Mr. Maunsell for the same countries for V.; Mr. Gresley for the same countries for VI.; Mr. E. J. H. Lemon, of the London, Midland and Scottish Railway, for the same countries, also America, for IX.; and Mr. C. R. Byrom, for the same countries as Mr. Lemon, for X.; American reporters have been designated for I. and XI.; and Japanese for II., VII., whose reports will include Great Britain, Dominions and Colonies.

Railway Matters.

THE Bills of the four grouped companies for road transport powers successfully passed their report stage on Thursday, July 12th.

MOST of the railways in Spain were built by British capital. They are very numerous and independent of State ownership. According to *Reuter* the Spanish Government has a scheme whereby all the smaller companies are to be absorbed by the two larger concerns—the Northern of Spain and the Madrid, Saragossa and Alicante Railway.

THE adjourned coroner's inquest into the Darlington railway disaster of June 27th was resumed and concluded on Tuesday last. The driver of the parcels train, whose knowledge of the road was evidently very meagre, admitted that he now recognised that he had passed the junction signals in the "danger" position. A verdict of "Accidental Death" was returned.

SINCE 1925 Indian railways have been experimenting with the external lighting of trains, partly with a view to augmenting the lighting at country stations, and partly as a safeguard against trespass into ladies' compartments and against train robberies. Two or more lights are provided on each side of the carriage, which are automatically switched in when the train is running below a certain speed limit and are switched out when the limit is exceeded.

THE fatal collision at London Bridge on July 9th was inquired into, on behalf of the Ministry of Transport, by Lieut.-Colonel Mount last Friday. From the Press accounts of the evidence it would seem that the driver of the light engine was given a signal to start, and then, seeing a signal ahead of him at "clear," he took it as his and continued running, overlooking an intermediate signal which was at "danger." The coroner's inquest was opened on the same day and adjourned until September 17th.

IN *The Times* of July 9th appeared a letter from a correspondent in which criticism was passed on railway companies, because, year by year, they make no provision for depreciation. The answer to that is that railway establishments do not depreciate but are kept up to their original standard out of revenue. That is why new engines are rarely built out of capital. What, too, is singular about a railway is that the compulsory replacement of existing works, *e.g.*, in the reconstruction of a station or enlargement of a yard, is a revenue charge despite the fact that the new works compel their replacement.

IN the Provincial Letter from our Lancashire correspondents that appeared on page 669 of THE ENGINEER of June 15th, mention was made of the Horwich Works of the London, Midland and Scottish Railway. In view of the facilities afforded by the modernised establishment at Crewe and that at Derby, those at Horwich, though only forty years old, may be considered as redundant. The first step towards economy has been the closing of the engine-shed, wherein ninety drivers, firemen, cleaners and other shed staff were employed. For them work has as far as possible been found in the neighbouring sheds at Bolton, Wigan and Chorley. The locomotive shops themselves present a greater difficulty. The 3000 men employed there have been put on short time, but their future being uncertain a deputation from the men has seen Sir Josiah Stamp. The result has inspired confidence, as it is hoped that if the railway companies get the road transport powers they seek, Horwich Works will be employed on the maintenance of omnibuses.

ACCORDING to the Board of Trade returns the value of the railway material exported during the first five months of the present year was as follows, the corresponding figures for 1927 and 1926 being added in brackets :—Locomotives, £1,614,547 (£770,161, £1,492,371); rails, £1,645,332 (£892,334, £991,467); carriages, £1,234,673 (£1,246,613, £1,032,836); wagons, £1,539,655 (£852,046, £1,463,146); wheels and axles, £416,006 (£224,483, £224,763); tires and axles, £256,695 (£204,142, £129,667); chairs and metal sleepers, £437,269 (£432,233, £422,812); miscellaneous permanent way, £633,633 (£612,931, £499,953); total permanent way, £3,455,542 (£2,492,931, £2,374,900). The weight of the rails exported was 189,786 tons (107,221 tons, 128,037 tons), and of the chairs and metal sleepers, 44,548 tons (43,584 tons, 43,180 tons). During the month of May last the value of the locomotives sent overseas was £385,261, which included :—India, £103,390; Ceylon, £43,448; Straits Settlements, £4020; Australia, £2798; South Africa, £2055; the Argentine, £1073. The value of the rails shipped in May was £196,325, and included :—The Argentine, £68,269; British West Africa, £15,467; New Zealand, £8734; South Africa, £6913; and Chili, £5303.

A POINT of no little interest to railway engineers and to road authorities was raised by a letter in *The Times* of July 4th. The writer claimed that, probably through an oversight in drafting, the Railway Clauses Act, 1845, only compelled a railway company to widen an overbridge where the bridge was not as wide as the roadway within 50ft. of the bridge—in other words, the bridge and the roadway within 50ft. of the bridge have to be of the same width. Mr. Chevallier, of Dawlish, the correspondent in question, would have the roadway responsibility extended to cover "the approach roads." He points out that the limit of 50ft. may not cover the whole length of the approach road; yet, as the remainder of the approach road may not be vested in the highway authorities the latter must bargain with the railway company so that the rest of the work may be done. We do not agree that there was any omission in laying down a distance of 50ft. as the extent of a railway company's authority. The clauses in question—sections 49, 50, 51 and 52 of the Act—very greatly favoured the highway authority as against the railway, and, in effect said : Bridges for turnpike roads must be 20ft. wide; whatever is the average width of the roadway within 50ft. of the bridge must be the width of of the bridge; if the roadway within 50ft. of the bridge should be made wider than the bridge "the company shall be bound, at their own expense, to increase the width of the said bridge to such extent as they may be required by the trustees or surveyors of such road."

Notes and Memoranda.

COMMENTING on a mishap to the boiler on a small steamer, the Engineer Surveyor-in-Chief, Board of Trade, says that it is probable that the vessel could have been taken into port under her own steam, but the auxiliary feed pump, used also for pumping out bilges, proved to be in a defective condition. The use of a feed pump for bilge pumping is most undesirable and should only be resorted to in a serious emergency.

AN unusual form of hydro-electric plant is described in the *Engineering News-Record*. It is on the Kentucky River, and a difficulty was that the whole length of the dam was required as a spillway, which may be flooded to a depth of 27ft. So the turbines, of 2000-kW, were arranged inside the dam, and the vertical shafts carried up to an overhead generator-room supported on tall piers. These piers are 36ft. high and house the shafts.

IN an account of a large blasting operation in a South Australian limestone quarry, given in the *Review* of the South Australian Department of Mines, some particulars are given of the shot holes, the explosives used and the results. Nineteen holes, 5¼in. in diameter, with an aggregate depth of 1145ft., were drilled and loaded with 5900 lb. of gelignite. The blast brought down a mass of rock measuring 43ft. by 399ft. by 60ft. deep, estimated to weigh 60,000 tons, which works out at about 10 tons of rock per pound of explosive.

THE number of furnaces in blast in this country at the end of June was 141, a net decrease of seven since the beginning of the month, three furnaces having gone into blast and ten having ceased operations. Production of pig iron amounted to 563,700 tons during the month compared with 591,500 tons in May, and 651,300 tons in June, 1927. The production included 181,200 tons of hematite, 203,800 tons of basic, 144,500 tons of foundry, and 20,700 tons of forge pig iron. The output of steel ingots and castings in June amounted to 709,500 tons, compared with 752,700 tons in May and 747,300 tons in June, 1927.

OPINIONS differ as to what effect moisture in coal has on spontaneous heating. Probably the effect of moisture is determined by the conditions of storage. If, says the American Bureau of Mines, we could be sure of wetting only those parts of the storage pile where spontaneous heating would otherwise develop, we could very probably prevent it. The heat required to vaporise the water would be more than the oxidising coal could supply. However, wetting down the surface of the whole pile changes the conditions of ventilation, and may favour heating at points not reached by the water, where dangerous heating would not otherwise occur.

DESCRIBING the natural steam power of California in *Nature*, Dr. E. T. Allen says that the wells bored in Geyser Creek ranged in depth from 400ft. to 650ft., and produced pressures, when closed, of from 95 lb. to 276 lb. per square inch. Measurements showed a steam output for the individual wells of 7500 lb. to 52,000 lb. per hour—average above 30,000 lb.—corresponding to a switchboard delivery—average—of about 1000 kilowatts per well at a pressure of 75 lb. The wells are separated by distances varying from 50ft. to 175ft., and none of them appeared to show any diminution in pressure or flow of steam due to the output of its neighbours.

THE following resolution of works committees, of which Mr. L. E. Mather is chairman, is published in *Industrial Welfare* : "(1) The committee method is applicable to practically every phase of factory administration. (2) The important thing is to have the committee in being, and then gradually extend its activities. (3) It is essential to have frequent and regular joint meetings of workers and management representatives, and to give publicity to the reports of the meetings. Meetings for workers only may or may not be necessary, according to the size and organisation of the factory. (4) We consider a works committee an essential part of our organisation."

A NEW process of emulsifying asphalt is, according to the *Chemical Trade Journal*, reported to have been perfected by the paint and varnish division of E. I. du Pont de Nemours &. Co. Pure asphalt is broken up into extremely minute particles in the presence of water and a very small percentage of inert mineral colloid. A specially designed high speed emulsifying machine is used for the purpose. Chromium salts are introduced in the manufacturing process to provide a rust inhibitor which renders ferrous metal passive to corrosive action while the water content of the emulsion is drying out. Advantages claimed for asphalt chromate emulsion include the retention of all the valuable protective properties of pure asphalt, the convenience of cold application with a spray gun or brush and the fact that the absence of volatile solvents make use in confined spaces safe, as neither toxic gases nor explosive vapours are given off.

A PROCESS for coating aluminium with films of zinc, nickel, copper or chromium, or combinations of those metals, has been evolved by Stafford O'Brien and Co., Ltd. It is an electrolytic plating process, which is said to be inexpensive and quite commercial. Anodic treatment results in the formation of a thin skin of oxide on the aluminium, which is non-conducting and non-corrodible in the ordinary atmosphere. This treatment, when not carried to its full extent, prepares the surface of the aluminium for the deposition of nickel upon it and of a coating of copper upon the latter. If required, after the copper film has been polished, a final coat of chromium can be deposited upon the other two, the finished article being bright and clean in appearance, thus obviating the need for polishing the chromium surface, which is, of course, very hard. It is claimed that the coatings are adherent and not liable to strip and that acid and salt-spray tests have been applied with satisfactory results. Aluminium alloys may be similarly coated without difficulty when their copper content is, say, not in excess of 6 per cent., preferably 3 per cent. Plant has been installed in London for carrying out the process on a commercial scale, the object being to stimulate the use of aluminium for purposes for which its light weight particularly fits it and harden its surface, so that it will retain its bright polished appearance and avoid the necessity for constant cleaning.

Miscellanea.

THE Great Western Railway has decided to close the Town Dock at Newport.

A PLANT for the production of liquefied carbon dioxide is being erected at Arsini in Armenia.

WORK is to be started very soon on the new Mining College at Cannock. It is to cost £23,000.

AN oil shale seam, several feet thick, it is reported, has been discovered at the Borough Colliery, Barnsley.

THE tin smelter at Bootle, of the Penpoll Tin Smelter Co., will have an initial output of 1000 tons a month.

IT is estimated that the manganese deposits near Postmasburg, South Africa, contain 500 million tons of ore.

THE New Brunswick Power Company has decided to extend its plant at St. John by the addition of a 10,000 horse-power unit.

THE name of the new amalgamation of Babcock and Wilcox and the Mitsui Bussan Kaisha is Toyo Babcock Kabushiki Kaisha.

THE production of metallic cadmium in the United States in 1927 amounted to 1,074,654 lb., an increase of 33 per cent. over 1926.

A NEW dry dock and coaling station are to be built at Prescot, Ontario, for the service of steamers coming from the Great Lakes, when the Welland Ship Canal is completed.

THE production of manufactured goods in Canada has increased from a total value of less than 500,000,000 dollars in 1900 to 3,500,000,000 dollars annually at the present time.

IT is reported that a gold placer has been discovered in northern British Columbia, from which Indians, working with very crude appliances, are earning as much as from 60 to 80 dollars a day.

A SERVICE of aeroplanes for transporting diamonds has been organised between Port Molloth and Cape Town. Three aerodromes are to be constructed at Steenkopf, Alexander Bay and Port Molloth.

A MESSAGE from Teheran dated July 10th states that contracts were signed on that day with a German-American group for the construction of two ports, one on the Caspian and the other on the Persian Gulf, and for the construction of a dam at Ahwaz.

THE first two locomotives to operate in Nova Scotia—the "Samson" and the "Albion"—were formally returned to the Province of Nova Scotia by the Baltimore and Ohio Railroad Company from its collection of famous locomotives on Halifax's Natal Day, June 21st.

THE forest reserves at present set aside in Canada total 6,500,000 acres, and there will soon be reserves of 25,000,000 acres, which it is proposed to care for in a scientific way. Such a reserve will furnish in perpetuity an annual cut equal to the present cut in British Columbia.

IT is hoped that the Ambassador Bridge across the Detroit River between Sandwich, Ontario, and Detroit, Michigan, will be finished by November, 1929. It is to have a span of 1850ft., and a headway of 152ft., while there will be room for five lines of traffic. The towers will be 352ft. high and the total cost about 20,000,000 dollars.

THE hydro-electric plants of Ontario produced a surplus of 1,291,986 dollars. The revenue collected by electrical utilities during the period totalled 24,583,022 dollars. The cost of power was 13,652,712 dollars; and cost of operation, maintenance, and administration, 4,681,466 dollars; while debenture charges and interest amounted to 3,694,855 dollars. Depreciation is set at 1,262,000 dollars.

ACCORDING to Mr. Harold S. Johnstone, chief engineer of the Nova Scotia Power Commission, the proposed power development on the Mersey River will comprise three units, and 20,000 H.P. will be provided for the newsprint mill which is to be constructed at Brooklyn. The total cost of the hydro development necessary to make possible the success of the newsprint mill venture will be approximately 3,659,000 dollars.

THE new coke plant of the Montreal Coke and Manufacturing Company is now in operation, and will have an annual capacity of 250,000 tons of high-grade coke, 6,500,000,000 cubic feet of gas, 3,500,000 gallons of tar, and 10,000,000 lb. of ammonium sulphite. The new plant adjoins the Montreal Power's gas plant at Ville La Salle, near Montreal. It has a battery of fifty-nine Koppers coke ovens, and a by-product plant for the recovery of tar and ammonium sulphite. About half a million tons of coal will be used in the plant each year.

WHAT is stated by the *Chemical Trade Journal* to be the largest plant in the world for the production of anhydrous alcohol has just been set into operation by the German Alcohol Monopoly at its plant in Berlin-Reinickendorf. The plant, which will produce 320 hectolitres of 100 per cent. alcohol per day, has been constructed by the Distilleries des Deux-Sèvres, according to the Ricard-Allenet patents. The dehydration and purification are effected in one step and the material is to be utilised for the manufacture of "Monopoline," a liquid motor fuel which consists of 90 per cent. of petrol and 10 per cent. of absolute alcohol.

HYDRO-ELECTRIC development has made great progress in Canada during the present season. Undertakings now in progress, either entirely new developments or additions to the existing stations, will this year add 550,000 H.P. to the volume of power available. Works in the initial stage of construction and others in active prospect, will, when completed within the next few years, result in an addition to the total installation of 2,000,000 H.P., and will require an aggregate direct investment of 200,000,000 dollars. One of the most important undertakings of the year is the running by the Ontario Hydro-electric Power Commission of a transmission to operate at 220,000 volts, 200 miles in length, to convey power furnished by the Canadian International Paper Company from its development on the Ottawa River, to Toronto, which is expected to be completed by October 1st. A 110,000-volt transmission line from Ottawa to Smiths Falls, to supply Eastern Ontario, is also being constructed.

THE STAFFORD WORKS OF THE ENGLISH ELECTRIC COMPANY, LTD.

(*For description see page 70*)

FIG. 1—PART OF THE SWITCHGEAR SHOP

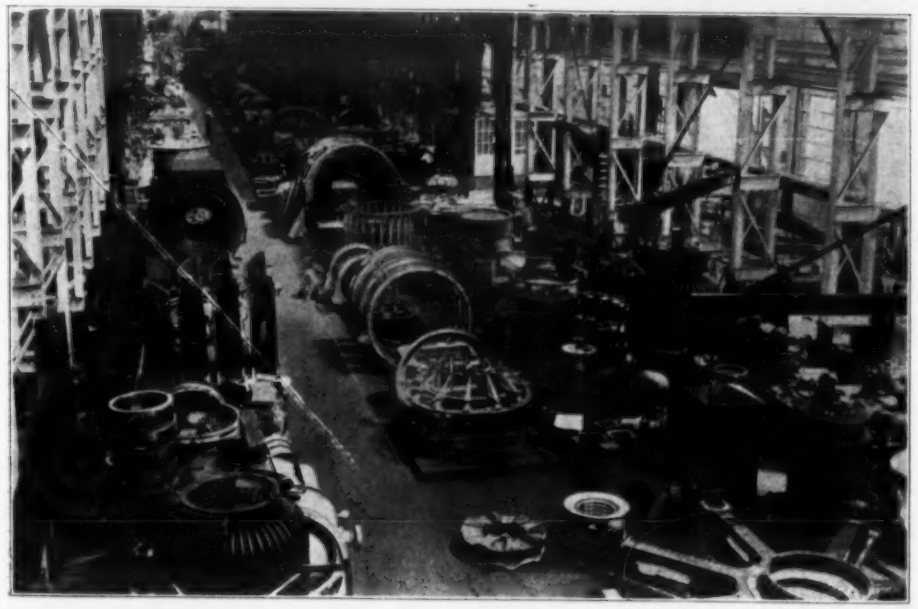

FIG. 2—MAIN HEAVY ENGINEERING SHOP

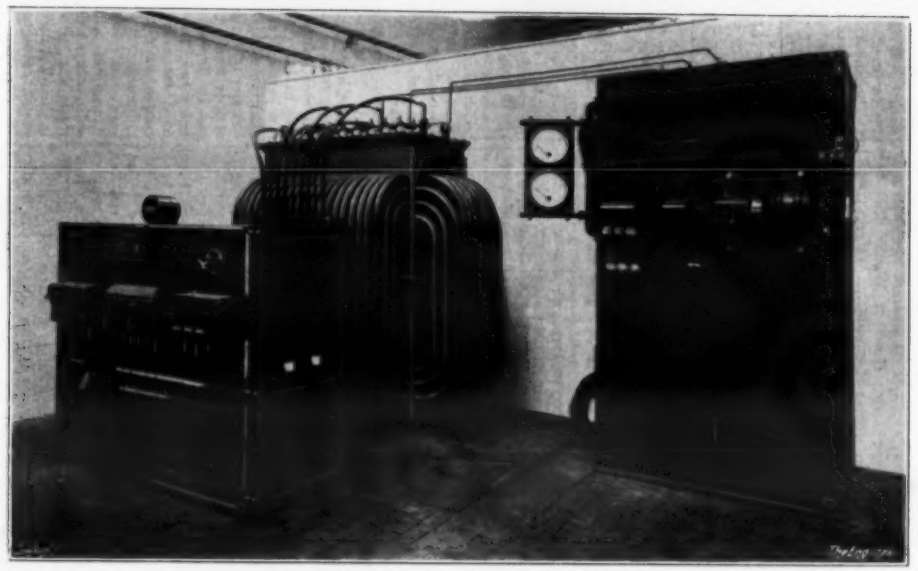

FIG. 3—DEMONSTRATION AUTOMATIC SUB-STATION

FIG. 4—PART OF THE TRANSFORMER SHOP

The Engineer

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SIXTEEN-PAGE SUPPLEMENT—INDEX TO VOL. CXLV.

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THE ENGINEER.

JULY 20, 1928.

The British Engineers Association.

THE British Engineers Association was established years ago with its eye on the East. The prospects of a vast market in China for British goods were then bright. All that was needed was a trade commissioner in the land of the Celestials and a united body of manufacturing engineers at home. The Commissioner would send advice ; the engineers would act on it, and the market would be secured. Things did not work out as anticipated. The British Engineers Association did not flourish as a trading organisation. The Chinese scheme fell through, and the B.E.A. changed its director and its tactics, and a new policy was inaugurated. The eye which had been turned upon the East became circumspective—it looked everywhere and at everything. The Association ceased to be active about selected markets. It took a large view of the interest of mechanical engineering and concerned itself with all matters that might effect the prosperity of manufacturers. It took up the study of statistics of the engineering industries ; it began to busy itself with world movements, and its influence was felt in Parliament. Did a commissioner want particulars of the conditions of the engineering trades, the B.E.A. provided them ; did a deputation want facts to lay before a Minister, the B.E.A. supplied them ; did a Member of Parliament want ammunition for an industrial speech, the B.E.A. was his magazine. Concurrently with this work on a broad basis, the Association was doing direct work for its members. Bulletins about contracts and the state of trade were issued to them, arrangements for their participation in exhibitions and shows were carried through, and those hundred and one affairs which can be handled better by corporate than by individual action came before it—all except those that have to do with wages and hours of labour, which were left to the Federation.

For many years the Association has been carrying out this policy. Of its value there can be no more doubt than of the energy, skill, and success with which it has been pursued. But the Association has never had the support from engineers which it deserved. Its membership is composed of manufacturing firms which subscribe annual fees estimated as a very small percentage of the wages paid. Even in the greatest days of prosperity, say 1920, the largest number of constituent firms was less than six hundred, and the income from fees about £10,000. There was an additional income from other sources—the sale of publications, services rendered to non-members, and so on—amounting to a couple of thousand pounds per annum, or thereabouts. The total annual receipts in those days may be set down in round figures as £12,000. When adversity fell upon the engineering industries the number of member firms and the income began to fall off. Some of the firms are, alas ! no more ; others have been "absorbed," and others are doing so little business that they have dropped out. There are now only 343 members and the income last year from membership subscription was no more than £5221. It is manifest that the Association cannot carry on, with such limited funds, the large policy upon which it has entered. Its very existence, even, is jeopardised. Something must be done to restore it to its old prosperity. It estimates that it could spend profitably to its members at least £10,000 a year. There are probably two thousand firms in the country which might be members, but if even half that number joined the income would be assured. It cannot be said that the fees collected from each would be great enough to affect materially a balance sheet. . . . In order to lay the position, which, as will be seen, is serious, before its own members, a meeting was convened on May 10th. A full report of it lies before us as we write. Sir Arthur Balfour was in the chair, and there were many speakers. Men who are eminent in the engineering industries testified to the valuable work done by the Association. Mr. W. Reavell spoke with his calm logic ; Sir Ernest Petter drove his points home with rhetorical energy ; and the director, Mr. Bremner, the mainspring of the mechanism, explained the advantages of membership, indicated the services which it had rendered to its members and dealt with the relationship between the Association and the Federation of British Industries. But they all knew, and most of them said, that they were addressing the already converted. New proselytes are wanted, and the report is being circulated far and wide to bring them in. And, indeed, these efforts deserve to be successful, for the case made by the speakers is a strong one. Mr. H. J. Ward, the President, made a good point. "We on the Council," he said "believe very strongly and unanimously that it is necessary to have a general representation for engineering ; that whatever usefulness the sectional associations have, it is absolutely necessary that we should have a general body, such as the B.E.A., and that if the B.E.A. were to come to an end tomorrow, in a very short time *a successor would have to be organised.*" That, we believe, is no more than the literal truth. One of the reasons most commonly given by firms for not joining the B.E.A. is that they are members of the F.B.I. Let us see what Mr. Bremner had to say on that point : "Because you have a great, powerful Federation of Industries, it does not follow that you need not have an organisation in your own industry. It must be remembered that any power the Federation of British Industries has is derived from its association members, and not from its individual members. They are a heterogeneous body representing everything from soap up to marine engines. It is from their affiliated associations that they get their representativeness and their authority. . . . With regard to the F.B.I., it is not a catholic body like that, which can render the specialised services required by the engineering industry ; nor could it speak for the engineering industry. It would not be listened to, and if it attempted to plead a cause for the engineering industry which happened to conflict in some degree with the textile industry or some other industry, whatever it might be, a line of cleavage would be established, and they would refrain from taking action." We understand that the F.B.I. does not challenge this view ; that it recognises the value of the B.E.A.; refers to it concerning matters affecting the engineering industry ; and desires to see it maintained at full representative strength.

It is impossible in the space at our disposal to touch upon other arguments which were advanced by speakers at the Conference. We must content ourselves with saying that their cogency is manifest. To the minds of the many eminent engineers who spoke, men engaged in the industry of engineering, the existence of the Association is a palpable necessity. We venture to put our endorsement to

that opinion. There are numerous occasions on which a representative policy must be advanced. That can only be done if a representative body exists. If it did no more than act as the mouthpiece of the engineering industry, the Association would be worth while. But it does more. It helps its members by intimate advice upon trading matters and it keeps them posted upon market affairs. By so doing, it helps the whole industry; for what is of benefit to one member of the industry is of benefit to all. It deserves to be encouraged in that service; it deserves to have the support of all the engineering firms in the kingdom. Were the subscription rate high, we could understand the reluctance of employers in these hard times. But it is not high. It amounts to approximately ten to fifteen pounds per annum—less than we pay to our golf club! The direct services may be set against a large part of that sum, and no one can calculate the value of the indirect services. It will far, far more than cover the remainder. We, therefore, do not hesitate to ask engineering firms to give the matter their earnest consideration, and, at any rate, read the report of the Conference before deciding that membership is not worth while.

Aircraft in France.

THE annual exhibition of aeroplanes which has just been held in the Grand Palais, Paris, marks another stage in the development of continental aviation. Outstanding events during the past year have shown that aircraft construction has made considerable progress. They have made it clear to our neighbours that they cannot lay claim to superiority when other countries have attained prominence in the different phases of aerial activity, such as the notable development of passenger traffic in Germany or the remarkable overseas communications which Great Britain has effected by means of flying boats and seaplanes, and the Italian record long-distance flight from Rome to Brazil. The French have been unfortunate in their efforts to secure some of the records, but the performance of Coste and Le Brix in flying round the world—except across the Pacific—has saved the situation, and has probably prevented disappointment from manifesting itself in a violent criticism of the alleged inadequate organisation of the French services. It has been decided to reorganise aviation, and at first it was proposed to create an Air Ministry; but it appears probable that the present separation between the Army and Navy air services will be maintained, although they will be kept under a central authority. It is hoped that this will have the effect of stimulating technical progress in aviation. As a matter of fact, this encouragement is not wanting, and the only thing to be said is that more importance is attached to military than to civil aviation, with the result that progress does not seem to have developed along practical commercial lines to the same extent as in some other countries.

For the first time, the Paris Show took on a really international character, for there was quite a large participation of German firms, and Italy, Czecho-Slovakia, Holland and Great Britain were also represented. After seeing everything else in the Show, the fighting machine exhibited by the Bristol Aeroplane Company, Ltd., with the panelling on one side removed to reveal the construction and equipment, was a revelation. Its sound mechanical construction was in pleasing contrast with the artifice in punching holes and stressing with wires in order to secure lightness which many machines at one time displayed. All the foreign machines which may be regarded as illustrating progress are noted for their clean appearance, and most of the French aeroplanes are now made with stiffer sections instead of with very small angles riveted and stressed with wires. Indeed, the old method of rather flimsy construction has practically died out, and, furthermore, it was noticeable at the Show that the majority of machines shown were built almost wholly of metal. Another feature is the increasing use of reduction gears between the engine and propeller. At one time it was feared that such mechanism would prove unreliable, but the type of gear usually employed has stood up to the work, and is now used on a number of the most prominent machines. There is, consequently, a tendency to adhere to the two-bladed propeller, and this also is often metallic. If we may judge from the fact that but one was exhibited, the variable pitch propeller has, so far, made but little headway. A thoroughly reliable and satisfactory device of this kind is desired, and would probably be adopted if all elements of risk could be eliminated, and if the weight were not unduly increased. Moreover, the greater range of angular velocities which can be given to engines at various altitudes with the aid of compressors has minimised in some measure the value of the variable pitch propeller; but a combination of a variable pitch propeller with super charging is still an object well worth persistent search. The Rateau turbo-compressor is now used very extensively. It is claimed by some engine makers that with its aid the maximum power can be developed at an altitude of 6000 m. In addition to the reduction gear between the engine and propeller and the Rateau turbo-compressor, another indispensable equipment is the self-starter. There were several devices of the kind at the Show, one of the most popular being the Viet, which consists of a hand pump, small air reservoir, and a supplementary hand pump for injecting gas into the cylinders on the compression stroke. In the construction of aeroplanes there is generally a noteworthy improvement. In this respect French makers have, perhaps, been more conservative in adhering to old methods than foreign aeroplane builders who introduced many of the now recognised features. Except for the Bristol there was no means at the Show of comparing continental aeroplanes with British, but the national characteristics of French, Dutch, and German machines could be studied. Each country has been working out its own constructional methods, and as every departure which appears to indicate an improvement is necessarily followed in other countries, there is a tendency, up to a certain point, towards unity in the principles of design and construction. French makers have, perhaps, more difficulty than others in re-adapting machines to civil requirements, because they are so closely bound to military requirements. Nevertheless, several firms have been giving more attention to the commercial side of aviation, notably Farman, whose latest machine for carrying twenty-five passengers deservedly attracted much attention. Every effort is now being made to develop machines which are needed especially for long-distance services to Africa and South America, but so far the attempts to give prosperity to the aeroplane industry by creating home passenger services and big international lines have not been successful. It is doubtful whether the home services can be made profitable, and the proposed new international lines involve great financial obligations. As there is a particularly large field for air transport in Africa, and as France is bound to improve the service she has opened with South America, makers are gaining experience in the construction of huge seaplanes. Unfortunately, some of the work now being done was not represented at the Grand Palais, although there was sufficient to show, for the first time, that steady progress is being made in France with seaplane construction. The Savoia-Marchetti, a bombing seaplane of all-metal construction, must be mentioned. It was with a machine of this type that Ferrarin and Del Prete flew from Rome to Natal, in Brazil, thereby making the world's long-distance record. This machine is regarded on the Continent as the latest development in big aeroplane construction, and it has certainly influenced the design of some of the new French machines, although the Italian seaplane has a distinctive appearance.

Reviewing the Exhibition as a whole, it may be said that it revealed a tendency for the various types of aircraft of all nations to follow certain well-defined lines of design and construction, but each country is still working out the problem in its own way, while profiting from the advances made by others, and many years must pass before what may be regarded as international types are common. Moreover, the requirements of each country are not the same. In Great Britain, leaving on one side the question of national defence, the problem is one of overseas communications, even to the limits of the Empire; in Italy the situation is much the same, since that country aims at reaching across the southern Atlantic; in Germany the development of aircraft is purely commercial, she is seeking to cover the whole country with a network of lines, but at the same time is preparing a vast scheme of air communication with North and South America; in France, aviation is mainly of a military character and the commercial side develops less activity through want of financial enterprise. In engine construction the French lead the way in the number of types, with such firms as Renault, Hispaño-Suiza, Panhard and Levassor, Gnome and Rhone, Salmson, and others, but the "Jupiter" engine, which is now built under licence in nearly all countries, was originally a British product, and there were certainly no better engines at the Show than those exhibited by the Bristol Aeroplane Company, Ltd., and by Armstrong-Siddeley Motors, Ltd. The rotary engine has practically disappeared, and the question whether the straight engine or the radial type engine is to be preferred, seems to be answered in favour of the latter. There do not appear to be many cases of straight engines being substituted for the radial type air-cooled engines, and the latter were more strongly represented at the Show than formerly, but the Germans use both types, and in Italy the V and W-shaped engines appear to retain their popularity. When one recalls the short time, less than ten years, in which designers have been able to develop aeroplane construction unhurried by the exigencies of war, it is rather a matter of surprise that so much conformity to certain basic principles has been attained than that some national divergencies still exist.

Literature.

The Design, Construction and Maintenance of Docks, Wharves and Piers. By F. M. DU-PLAT-TAYLOR, M. Inst. C.E., &c. London: Ernest Benn, Ltd. 1928. 70s. net.

THIS well-got-up and somewhat bulky volume, to which Sir Joseph Broodbank contributes a short introduction, gives the impression of lack of balance. Some of its chapters contain adequate and indeed full accounts of particular aspects or details of the author's subject which appear to have specially interested him, while others of equal or even greater practical importance are dismissed with a brief reference or receive no attention whatever. Even when Mr. Du-Plat-Taylor sets out to cover the ground in thorough fashion, his heart fails him—or perhaps the thought that he is exceeding the limitations of space laid down by his publisher restrains his hand—before he has progressed further than the very beginnings of things. Thus, his first chapter is an interesting account of the harbours of the ancients. The ports of Greece and Rome and even pre-Hellenic harbours are described, but after twenty-one pages we have got no further ahead than—

> ". . . . the glory that was Greece,
> And the grandeur that was Rome,"

and jump straight on to dock organisation and management. There is nothing about early dock construction in Northern Europe, or of the beginnings of such ports as London, Liverpool, and Bristol. There is no reference to that delightful work of Bélidor in which we learn so much of seventeenth century and early eighteenth century port construction. After becoming interested in the ancient ports of Carthage and Ostia, Alexandria and Antium, the reader would like to know something of those early seventeenth century dry docks at Deptford and Bristol, and that first closed wet dock on the river Thames which is mentioned by Mr. Pepys. We note in passing that Mr. Du-Plat-Taylor refers to the supposed remains of an ancient harbour, discovered at Alexandria, as Cretan. This ascription has been disputed by competent authorities, and Sir Arthur Evans in "The Palace of Minos" does not accept the evidence in support of Cretan origin as conclusive.

To revert to the plan and scope of the book. It seems to us that the author has elaborated those sections which interested him personally or which cover work which has come within his own experience. These are the best parts of the volume; they are full of practical suggestions and notes of warning begot of experience. Here there is little evidence of scissors-and-paste work.

In his second chapter the author discusses the organisation and management of docks and harbours. Many readers of experience will disagree with his conclusions on this branch of his subject, as does Sir Joseph Broodbank in his introductory note. Briefly, Mr. Du-Plat-Taylor regards a combination of State ownership and working by management commissioners as the ideal organisation for a port. His plan would in many respects be similar to the French system, which he says "appears to be an admirable one." Yet he admits that it has failed in execution, owing to the interminable delays occasioned by it. The author might, we think, have made better use of the analogy of United States ports in developing his argument, for, in fact, it does, in some small degree, support his contentions. But he makes no reference to the system of federal control of all tidal waters and navigable rivers and lakes in the States. Under this system the Federal Government controls, improves and maintains all harbour approaches and waters, carries out dredging, lighting and buoying; in some cases builds protecting breakwaters, and in rivers constructs the weirs and locks for the improvement of navigation. The local authority, be it State or Port Commissioners, only provides and works the wharves, quays and port equipment. This system of partial Federal control is probably the best, having regard to the peculiar conditions of United States ports, where many of the

principal ports are bounded by territory of more than one state and where the great rivers often traverse several states. The author's brief reference to United States ports is liable to mislead readers unacquainted with the facts, for it omits the most important factor of the case.

Among the arguments used by the author in favour of State ownership is the one that military and commercial port works might be merged, with consequent economies. In elaborating this argument, he says that since the lengths and draughts of battleships are less than those of the largest commercial steamers, naval dry docks would have to be built of greater *depth* if used for the largest liners. But we may remind him that the depth of a naval dry dock is determined, not so much by the normal draught as by the possible draught of a crippled ship. Rosyth, planned over twenty years ago, has 50ft. depth over its entrance lock sill at high water neaps, and 40ft. over the dry dock sills with an available width of 105ft. The new Singapore dry dock is, we believe, to have an entrance 130ft. wide and 44ft. deep over sill. The provision made as regards depth in modern naval dry docks is, speaking generally, at least equal to that afforded by the largest commercial docks.

The two chapters on "Forms of Accommodation" are interesting, but dock engineers will not, we think, be prepared to accept all the author's statements. For instance: "It is more than probable that within the next few years tidal berths will supersede [enclosed] docks in all ports where the maximum range does not exceed 25ft." Then the statement that in closed docks "the water is maintained at a uniform level by means of gates," is not strictly correct, for in many such docks, where pumping is not resorted to, there is a considerable difference between the depth impounded at spring and neap tides respectively. The author describes what is usually known as a "half-tide dock"—as at Liverpool—as a vestibule basin. Probably the older term is preferable and more descriptive, particularly as the term "vestibule" is used at Liverpool and elsewhere to indicate the wide turning area in the dock proper, as in the new Gladstone docks. The statement that there is in the Gladstone Dock only room enough for turning "a ship about 600ft. long" is clearly a slip of the pen, for the author must be aware that the Mersey Docks and Harbour Board has just completed the building of that dock for the 1000ft. ship of the future. Referring to the high cost of berths for the largest class of commercial steamships in closed docks, Mr. Du-Plat-Taylor points out that these berths are much less remunerative to the dock owner than the accommodation provided for smaller vessels, but adds that with tidal accommodation, "the provision of such berths is not much more expensive than those for smaller vessels"—a far too sweeping statement.

Chapters V. to IX. inclusive cover the subject of dock and wharf walls fairly fully; the part dealing with calculations and failures is clear and of special value to the student. References to original papers, where further details of many of the types of wall could be found by those specially interested, are, however, few. In fact, it would have added greatly to the value of the book if it had been more fully and systematically documented. We have noticed a few errors of reference which, no doubt, will be corrected in future editions. One relating to dock walls on page 95 should read "London" instead of "Milan." In describing concrete block walls, the author omits to mention the use of sloping blocks in quay walls, now a common form of construction on compressible foundations. Monolith foundations for dock walls are described at length, but it is not mentioned that brick single-cylinder foundations, something like the well-known Indian wells, were used on the Clyde about 1870, we believe, by James Deas, before he introduced the trefoil form which the author illustrates. Nor does the author refer to the Rosyth monoliths—some of the largest and deepest ever sunk in this country or overseas. Several examples of quay wall foundations formed in caissons sunk under compressed air are described, including the movable caissons suspended from pontoons adopted at Antwerp in 1898. The same method was, however, in use at that port much earlier—we believe in 1880—in constructing a long range of river quays. Several types of quay walls built of reinforced concrete caissons are described, but reference might well have been made to some more recent examples of a form of construction which has made rapid progress in the past five years. One example, illustrated by the author, was designed for Yokohama Harbour, and is described as having been built, but we believe the work was never actually carried out.

A chapter is devoted to jetties and landing stages, which is comprehensive so far as British practice goes, but owing, no doubt, to the limitation of space, includes only one example of the cargo piers and jetties which form such an important feature of North American port construction.

The account of dry docks and floating docks is prefaced by a reference to slipways, of which the author says, "many . . . are still in use for trawlers and similar craft." A reference to Lloyd's List or the Admiralty Dock Book will show the importance and wide use of this form of ship-repairing equipment, particularly abroad, to be very much greater than the author's words might be taken to imply. Slipways in Europe which take vessels up to about 4500 tons are fairly numerous, and in North American waters there are many of still larger capacity. It is desirable to mention that the illustrations of the new dry dock now being built at Tilbury which appear on page 185 as well as the description of the blocks are not correct. Unfortunately, the author has made use of a drawing now apparently superseded. The section of the dock as actually carried out differs from that shown. The blocks are to be of cast steel, not of timber, and hydraulic bilge blocks are, we understand, to be used instead of the chain-operated blocks illustrated.

To the list of the largest dry docks "recently constructed or projected," on page 198, additions should be made in future editions. The docks at Balboa (Panama, 1916), Congella (Durban, 1925), St. John, N.B. (1923), and Boston, U.S.A. (1920), are all in use, and are on a par with the largest named in the author's list. The descriptions of dock gates, caissons for entrances, gate machinery and sluices seem to us to be inadequate to the importance of the subjects. As an instance of this, caissons are referred to very briefly, a short description is given of one ship—or floating—caisson, and no distinction is drawn between sliding and rolling caissons. In fact the only other caisson mentioned is a comparatively small rolling caisson at Zeebrugge, over twenty years old, which is described as a sliding caisson. No mention is made of the very large sliding caissons at modern Admiralty docks and at the Gladstone dry dock and Southampton, nor of the modern rolling caissons at Antwerp, Ymuiden, and other ports.

Three of the most valuable chapters come at the end and describe the construction of dams and other temporary works and the maintenance of dock works. Here the author is evidently writing from his own experience. The same remark applies to the chapter on materials, almost entirely devoted to concrete in its many forms and uses. His account of methods of trench sinking, timbering, and cofferdamming is particularly good and is well illustrated. In this section foundation caissons are also described; among them the large permanent caisson used in forming the foundation of a dry dock at Toulon, which is the prototype of the very large caisson employed many years later, we believe, by the same firm of contractors, in constructing the dry dock at Le Havre, recently completed. The author's remarks on pumping in connection with foundations and temporary works are interesting, and he mentions the importance of information as to the hydraulic gradient and the distance to which the effect of pumping will extend. He adds that "this is a matter which has not been closely investigated, so far as the author is aware." We might remind him of the filter wells largely employed in Holland and Belgium since about 1910 in connection with pumping for dock construction. There is a good deal of interesting information available as to these and the engineering literature of underground water supply also contains valuable data.

The two chapters on dock maintenance deal with matters which, so far as we are aware, have hitherto received little attention from writers on dock engineering. They will be read with profit, not only by students, but by engineers having the charge of dock maintenance. The chapters on dock and wharf buildings and miscellaneous equipment furnish a brief sketch of the granaries, cold stores and warehouses which usually form some part of the equipment of British docks.

The short bibliography might have been extended with advantage, particularly in the direction of including some recent French and German works, of which there are several of real importance, and American references. Mr. Du-Plat-Taylor has perhaps attempted too much in one volume at one time. The result is the contrast of excellent, informed and valuable chapters set side by side with others which are less satisfactory. Nevertheless, the volume is a useful addition to the very limited literature—in English—of dock construction.

Foundations. By WILLIAM SIMPSON, M. Inst. C.E., M. Inst. Mech. E., M. Inst. Struct. E. London: Constable and Co., Ltd. 1928. Price 18s.

ONE of the Glasgow text-books of civil engineering, edited by Professor G. Moncur. Its author was formerly Chief Engineer for the port of Sunderland. So many authors, when writing on subjects of wide and varied application to engineering design, fail to present adequately any aspect of the subject, that it is reassuring to find that the sub-title of Mr. Simpson's text-book is "The Examination and Testing of the Ground Preliminary to the Construction of Works," while an additional sub-title is "Methods and Appliances." The work does not include any consideration of the structural foundation, but it does adequately and very usefully present the subject as defined in the sub-title, while it contains nothing that is irrelevant or trivial. Beginning with a chapter on geological conditions in relation to works of construction, the author proceeds, in the six following chapters, to describe methods of examination, on land and under water, by means of probings, percussive and rotary borings, the sinking of bore-holes and shafts, and excavations. The 250 pages are apportioned, very fairly, to text and illustrations, the latter, 231 in number, being of unusual merit and clearly depicting the nature of the operations, the forms of the apparatus or plant, and details of important parts.

The opening chapter deserves special mention as tending to establish in the mind of the reader that sense of the significance of geology in relation to foundations, the lack of which has led to great disasters. The objects of the geological survey are usefully distinguished as relating, first, to the structure and, secondly, to the lithology of the area. Usefully, because either the one or the other is sometimes studied by itself, with the result that foundation conditions of importance are overlooked. The author's study is quite elementary, the reader being advised to study geological works, a list of useful volumes being provided in the author's bibliography. He presents some leading examples of the significance of dip and strike and depicts typical cases showing the relation of the strata to roads, dams, and tunnels, works in superficial deposits being separately discussed and illustrated. In this and the succeeding chapters the illustrations, though quite suited to the book as a handy volume for the use of engineers, are completed in such a manner that the nature of the operations in relation to the strata may be made very clear to students, typical soils, silts and rocks being duly shown and, where necessary, plans as well as sections. Tools and important parts are sufficiently illustrated, but there are no vain repetitions of the merchant's catalogue type. The descriptions of percussive boring and of the dispositions of staging and barges for work through water are presented more fully and more clearly than is usual in books dealing also with the other operations described in this volume. In the final chapter, on testing ground for bearing and compression, descriptions are given of large area tests, standard area tests, and load tests for deep and for shallow foundations; most of this matter being in pleasing contrast with the vague references to this or that condition which are sometimes regarded as sufficient under this head. The author explains throughout how the data obtained are used. He refers to such matters as accidents during boring operations, the recovery of lost parts, and various practical details. The book may be recommended as suitable for both engineers and students, but those to whom the subject is new should perhaps be reminded that when foundations for relatively modest structures have to be provided it must not be assumed that examinations such as the author describes are always necessary. Leaving small buildings out of consideration, though careful examination may be desirable before their foundations are laid, there are many cases in which sufficient evidence or information is available to justify beginnings of construction which, if no foundation be found, are yet less costly than a proper examination. This caution is given because the single word "foundations" has had to serve as the title, with the additions already noted, but on the back of the book only the words "Methods and Appliances."

Letters to the Editor.

(We do not hold ourselves responsible for the opinions of our correspondents.)

RAZOR BLADES.

SIR,—Very many readers are interested in the letters on this subject, not so much as engineers, but as shavers.

For years I have pondered at about 7.15 a.m. on the cutting angles of steel when opposed to bristles, and your correspondents who have written so interestingly on the subject should be encouraged to go further. Razors and their qualities are only part of the story.

I, personally, use "cut-throat razors," and I have bought or acquired some nine or ten since adolescence. Their individual histories are interesting to me, but too long to relate. Most are bad, some are good at times, and one is good for four months provided it has a holiday of eight or ten weeks after that period. I have one razor that is splendid provided the barometer is very low. Is it beyond the region of possibilities that a Razor Makers' Trade Board will one day issue certificates for a high-class razor that is A1? By A1 I mean fit to shave with.

The counterpart of the razor is the strop. Why cannot one buy a strop that bears any resemblance to such a strop as a barber uses? Another point, why has the old stiff knife-board strop disappeared? Is it worse or better than the strop? If the strop is best, should one use the leather or the canvas and with what should the material be treated?

These casual remarks will, I hope, stir some public benefactor—preferably and most suitably a razor maker—to investigate seriously and studiously the whole art of stropping the casual bits of steel one acquires. The Institution of Mechanical Engineers has spent a considerable amount of energy and money on less worthy subjects. The first duty of a citizen is to acquire happiness; before breakfast, if possible. I can imagine no other form of scientific investigation coming within the orbit of "The Mechanicals" that would be productive of so much good to humanity. Cannot they tackle this problem properly and make a job of it? W. A. TRITTON.

Lincoln, July 9th.

A Visit to the Stafford Works of the English Electric Company.

DURING the latter part of last week a large party of engineers interested in electricity supply visited the Stafford works of the English Electric Company for the purpose of witnessing a demonstration of the Wilkinson change circuit system for improving the load factor of electricity undertakings. The apparatus has been devised by Mr. Geo. Wilkinson, late Chief Electrical Engineer at Harrogate, and its object is to maintain the load on generating plant more or less constant by supplying current to a thermal storage system as the ordinary load diminishes.

As Dr. Ferranti remarked during the course of one of the discussions at the recent Civil Engineers' Conference, the design of the load is every bit as important as the design of the plant. Any scheme that aims at filling in the valleys of the load curve is worthy of consideration, for, as every engineer knows, nothing is more important than continuous profitable employment for the station plant.

The principle of the scheme is easily understood. Briefly, it involves the use of two independent feeders with one common supply line, as indicated in Fig. 5, which shows a simple single-phase scheme. The feeder for the ordinary load is, of course, maintained at constant voltage, but the other feeder supplies current to the water heating apparatus at variable voltage. The electrical pressure on the thermal storage circuit is changed by an automatically controlled induction regulator which can reduce the pressure to zero or raise it to double that of the normal supply circuit. As the pressure at which the thermal load is supplied has a maximum value equivalent to twice the normal voltage, the extra conductors, which the scheme calls for, are of relatively small section.

The scheme can be applied to a single-phase three-wire system in the manner shown in Fig. 6, and to a three-phase four-wire system as shown in Fig. 7. The induction regulator is auto-connected, *i.e.*, it is designed with a 1/1 ratio and the stator and rotor windings are connected in series. When the transformer is working at its full capacity with the ordinary constant pressure domestic and lighting load the voltage across the regulator is zero. No current is then supplied to the thermal storage circuit, but when the normal load falls to its minimum value, as in the early morning, the regulator gives its maximum pressure and the total load on the transformer is maintained constant by the thermal storage system.

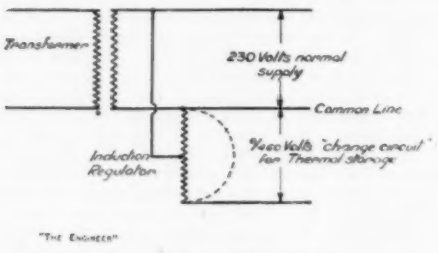


FIG. 5—SINGLE-PHASE SCHEME

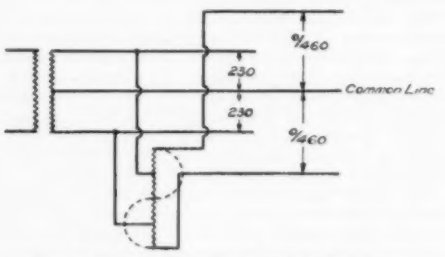


FIG. 6—SINGLE-PHASE 3-WIRE SYSTEM

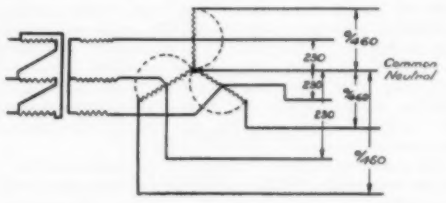


FIG. 7—3-PHASE 4-WIRE SYSTEM

DEMONSTRATION APPARATUS.

The demonstration apparatus at the English Electric Company's works is shown in Fig. 8, and a separate view of the induction regulator and automatic control gear in Fig. 9. The automatic gear that operates the rotor of the induction regulator is mounted as a self-contained unit in the upper part of the tank. In this particular case an alternating-current motor consuming about 35 watts drives a crank continuously through worm reduction gearing, and this crank oscillates a pair of pawls and triggers over the periphery of a reversible ratchet wheel. A relay connected to a current transformer as shown in the left-hand upper corner of Fig. 8 controls a balanced arm, by means of which one or the other of the triggers is tripped, thus causing the corresponding pawl to engage in the ratchet wheel which rotates the induction regulator rotor through the worm wheel in the desired direction. The principle will be readily understood by those familiar with the original Thury regulator as designed by M. Thury for his high-pressure direct-current system.* By movement of the rotor of the induction regulator in one direction or the other the load on the transformer is maintained constant irrespective of variations in the domestic and lighting load.

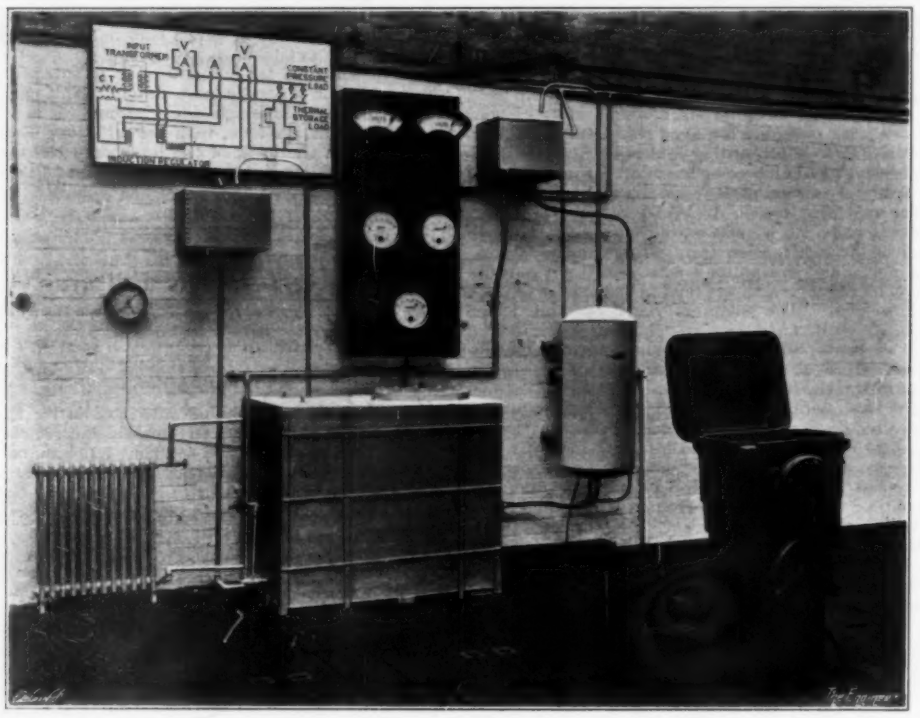


FIG. 8—DEMONSTRATION APPARATUS AT THE STAFFORD WORKS

DOUBLE-RANGE REGULATOR.

In the case of new sub-stations a cheaper arrangement is possible by utilising the English Electric Company's patented double-range regulator, the arrangement of which is shown in Fig. 10. This reduces the size of the regulator by about 50 per cent. and the losses are also diminished. The scheme is applicable to three-wire and four-wire circuits as in the case of the normal auto-connected regulator described. This double-range type of regulator is recommended wherever possible on account of its low first cost. In some cases, however, as in small transformer sub-stations, it may be more economical to employ a tapping switch arrangement on the secondary of the transformer, a scheme which dispenses with the induction regulator. The maximum pressure on the change-circuit system—see Fig. 11—will, in this case, be the same as the normal pressure across lines, which means, of course, that the cables will be of equal section. But for small feeders the cost of excavation is large compared with the total cost. Thus the heavier section of the change-circuit feeder may not prove detrimental to the scheme. Every case must be considered individually. In order to ascertain which scheme is most desirable from a commercial point of view it is essential to take into account in each case the total expenditure, made up of the cost of feeders plus the extra cost of a transformer or a transformer and regulator. Obviously fine voltage regulation on the thermal storage circuit is not essential. The secondary winding of the transformer need not therefore have fine steps. As the thermal storage load varies as the square of the voltage, the tappings would be logarithmically spaced and arranged for approximately equal increments of load. It is improbable that the use of direct current for domestic purposes will be extended to any appreciable extent, but in any case for the most part direct-current supplies are derived from rotary converters and it would be an easy matter to arrange for an alternating-current supply.

* See THE ENGINEER, November 14th, 1902.

SIMPLIFIED CONTROL GEAR.

The automatic control gear for feeder voltage regulators which must maintain the pressure within ± 1 per cent. of some predetermined value is an expensive item, and a simplified arrangement—see Fig. 12—has therefore been developed. As it is the maintenance of a constant current on the input side of a transformer that is aimed at, the control impulse is initiated from a current transformer in series with the primary supply feeder. The secondary current of this transformer, which is proportional to the line current, heats a thermostatic strip consisting of two different nickel alloys rolled together. At 15 deg. Cent. the strip is flat, but with an increase of temperature it deflects. The free end of the strip works between two contacts, which are adjusted so that with normal full-load current no contact is made in either direction. But if the load varies the change of temperature of the strip causes contact to be made in one direction or the other, thus closing the contactor circuit for raising the volts or for lowering the them on the change circuit regulator. To compensate for changes of atmospheric temperature, the contacts are carried on similar bi-metal strips, designed to ensure uniform spacing of the contacts

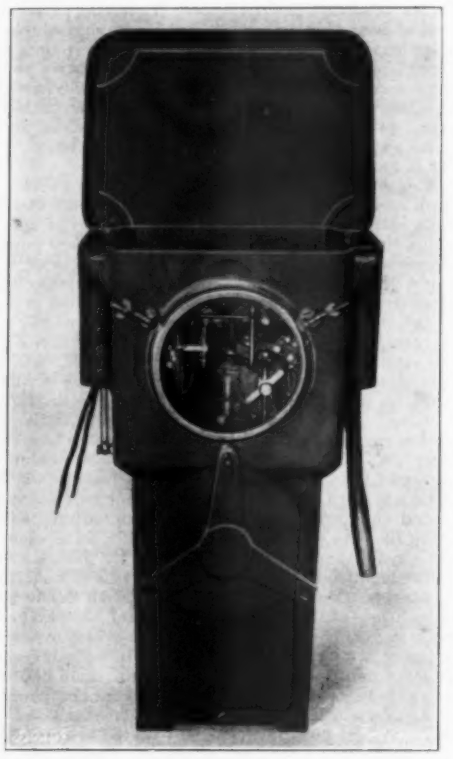


FIG. 9—INDUCTION REGULATOR AND AUTOMATIC CONTROL GEAR

at all temperatures. The scheme is also employed for another form of compensation. The amount of surplus load that can be absorbed by thermal storage obviously varies according to the time of year. But by providing another current transformer in the change feeder circuit, and by causing the current to heat the bi-metal strips which carry the relay contacts, the total load which the regulator will maintain constant may be altered. If this compensating current transformer be shunted with a variable resistance, the load factor may be adjusted at will.

THE FINANCIAL ASPECT.

The financial aspect of the change circuit system has to be examined in each particular case, as production costs and the distribution charges vary in different areas. The example given below, which is claimed to be typical of the conditions in the neighbourhood of most industrial districts, shows that a

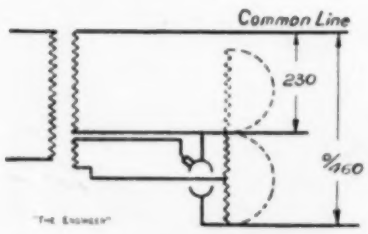


FIG. 10—DOUBLE RANGE REGULATOR

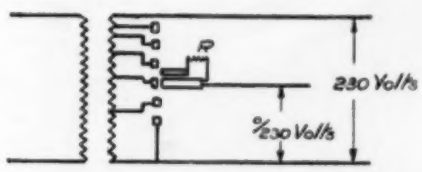


FIG. 11—TAPPING SWITCH ARRANGEMENT

profitable return can be obtained when supplying a thermal storage load at quite a low rate. It shows a net return of 25 per cent. on the sale of current or 10 per cent. return on capital outlay after paying interest and sinking fund charges, even when applied to an existing installation. The case considered is one where a 75-kW kiosk sub-station for 6600/400 volts is installed for the ordinary lighting and power supply, with, say, 1200 yards of 0·15 square inch four-core cable for a three-phase four-wire distribution. The approximate cost of this, including excavating and reinstating, would probably be about £1800. The cost of adding the necessary apparatus, cabling, &c., for giving a change circuit supply at variable voltage for heat storage and kindred purposes, would be approximately as follows :—

Cost of regulator, automatic gear, 1200 yards of three single-core ·06 square inch cable, excavating and reinstating	£900
If regulator and cable installed at same time as the transformer kiosk and main distribution cable, this would be reduced to	£630
Existing load at 25 per cent. load factor, units per annum	164,000
Load brought to 80 per cent. load factor, units per annum	524,000
Load in change circuit, units per annum	360,000
Coal, oil &c., ·22d. per unit	£330
Interest and repayment, 8 per cent. on £900	£72
	£402
Revenue at ·33d. per unit	£500
Profit	£98

The coal and oil costs in the example are based on

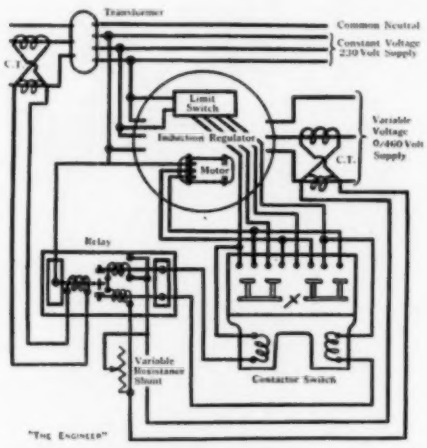


FIG. 12—CONNECTIONS FOR CONTROL GEAR

the 1926 figures published for Edinburgh and Leeds. It is pointed out that as these figures include stand-by losses in the generating station which will be reduced rather than increased by the change circuit distribution, a reduction may be made in the cost quoted. On the other hand, the load factor of these stations was nearer 27 per cent. than 25 per cent. The change-circuit principle is particularly applicable to densely populated residential areas, suburban areas and garden cities, where the number of "all-electric" houses and electrically equipped flats may be expected to increase at an accelerating rate. Domestic heat supply is, however, by no means the only application of the change circuit. Numerous industries employ heat processes where thermal storage would provide a night load. Hotels, laundries, fermentation processes and food preparation are a few of the many possible applications.

CHANGE-CIRCUIT DISTRIBUTION.

In a pamphlet on the change-circuit system, written by Mr. Geo. Wilkinson, it is stated that the original object of the scheme was to increase the output from all existing generating stations, thus increasing their utility; and to provide energy in its most useful form for heating purposes at a cost well within the means of ordinary consumers to pay, *i.e.*, on terms really competitive with other available means of heating. Investigations, in co-operation with leading cable manufacturers, prove, however, that change-circuit distribution for a given amount of power is substantially cheaper than the equivalent distribution on constant-pressure circuits. There are two reasons for this. First, the distribution on change circuits is effected, on heavy load, at double the electrical pressure of the constant-pressure supply; thus, for the same load and for the same losses in the cables, half the copper only is required. Secondly, the maximum drop in pressure legally allowable on constant-pressure mains is 4 per cent., whereas—owing to the extra units supplied through the change circuits costing little more than the extra fuel consumed in their generation—the maximum loss on full load may be as high as 10 per cent. without transgressing any sound commercial principle, or impairing the efficiency of the supply. Again, change-circuit supply imposes no addition to the usual maximum load on the high-pressure mains, as is the case if the energy is supplied at constant pressure. Therefore, while heat supply on constant pressure entails additional burden and cost upon high-tension mains, there are no such additions where change-circuit supply is used.

INDUCTION REGULATORS.

The English Electric Company specialises in the design and manufacture of induction regulators of all types and sizes, and claims to have made more of these regulators than any other firm in the country. One of the most interesting regulators brought to our notice was that shown in Fig. 13, which has been built for the purpose of counteracting extremely rapid variations in voltage. It is to be used on the Richmond system, which takes a bulk supply from a large traction power station. The problem was to design a regulator that would operate with great rapidity, and thus smooth out the extremely rapid fluctuations on the lighting network. The operating gear has been designed so that it will give the full amount of regulation of plus or minus 10 per cent., or a total regulation of 20 per cent. in 1½ second. The regulator is to be used on a 300-kVA feeder, operating at 440 volts and 33⅓ cycles.

THE STAFFORD WORKS.

During our visit we were afforded an opportunity of inspecting the whole of the works, which form a well-known landmark on the main line of the London, Midland and Scottish Railway. They are situated on a site of about 56 acres on the outskirts of the town, which, it will be recalled, lies in a rural district approximately midway between the Black Country and the Potteries. The workshops, which cover an area of 7½ acres, are divided into two main sections that radiate from the testing and the dispatching departments, which are thus common to both. One section is occupied in the production of heavy electrical machinery and transformers—see Fig. 2 on page 66. The other in the manufacture of switchgear.

During recent years the switchgear department has been considerably extended, and it now has a floor space of about 100,000 square feet, devoted solely to the designing, fabrication, and assembly of this class of apparatus. This area is exclusive of the foundry, pattern shop, smithies, tool shop, testing and dispatch departments, which serve the whole works. Switchgear has been produced here for over twenty years, and the latest extensions give facilities for the largest sizes of apparatus required for the control of modern super-power stations and extra high-tension transmission lines. Part of the switchgear department is shown in Fig. 1 on page 66. The general lay-out of the works is well arranged for the economical routeing of the processes, from the raw material to the assembly and dispatch of the finished apparatus. In the eastern block of buildings there is a number of bays with the main stores running transversely across them at the northern end. On the extreme east is the machine shop with the special finish annexe at one end. Parallel to this are the detail assembly and small switchboard assembly shops. On the western side is a larger and higher block, which forms the large assembly shop leading at its northern end into the dispatch department.

In the detail assembly shop are assembled complete apparatus of the smaller kinds and the main components of larger apparatus. To facilitate this work there is a calibration, flashing and general testing section attached to the shop, so that individual apparatus can be adjusted and checked before final assembly or transference to the finished goods store which is adjacent.

The large assembly shop is a well-lighted bay, 370ft. long and 23ft. high to the crane rail, and in it are erected slate switchboards, steel structures, oil breakers and similar large control gear.

The special finish annexe is a busy and important auxiliary to the main processes, and is equipped for plating with tin, copper, zinc, silver and nickel, for spray coating and for stove enamelling. The newest methods of treatment are continually being investigated, and some little time ago experimental work was carried out on plating with chromium and cadmium. Finish plays a highly important part in

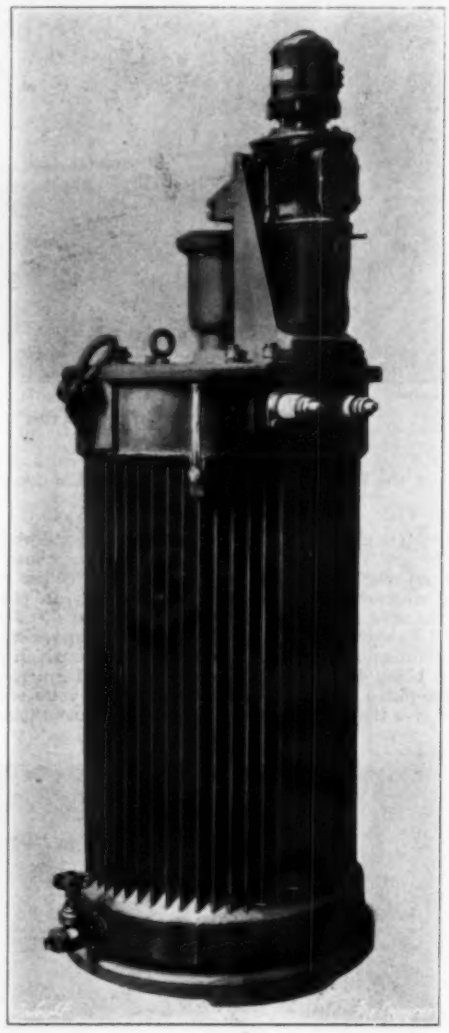


FIG. 13—INDUCTION REGULATOR FOR RICHMOND

switchgear of all kinds, for while protection from corrosion, adaptability to cleanliness, and good appearance are valuable features, there are also certain problems arising from the Peltier effect, which can be largely diminished or eliminated by suitably plating contact surfaces which for one reason or another are of different metals. Considerable use is now made of cellulose paint in various colours for spray-coating the interior of relay casings, &c. It is quick drying, durable and of good appearance.

Testing of complete apparatus, where possible in conjunction with the plant it has to control, is carried out in the main test bay of the works. The design, manufacture, and testing of machines, transformers, and control gear go hand in hand, with the result that any developments in one can be followed closely by suitable developments in the associated plant or apparatus. Part of the transformer department is shown in Fig. 4 on page 66.

On alternating-current systems the operation of plant and control gear depends in a peculiar degree on auxiliary transformers of various types. The manufacture of the wide variety of types and sizes required is carried on in a special gallery in the transformer department of the works, and the decision to manufacture this class of accessory apparatus has been wholly justified by the saving in time of delivery, the

flexibility in design and the high standard of quality that have resulted.

The greater part of the switchgear produced at Stafford works is for the control of alternating-current systems, and a complete range of the necessary apparatus can be supplied for working pressures up

FIG. 14—15,000 H.P. WATER TURBINE ALTERNATOR FOR PERAK

to 220,000 volts. For pressures of 44,000 volts and above, the apparatus is usually installed out of doors.

TURBO-ALTERNATORS.

Much might be written on these extensive and well-laid-out works, but it must suffice to call attention to several machines, &c., which were in the course of manufacture or were being tested during our visit. One of the most important turbo-alternators was a 31,250 kVA 50-cycle machine for the Glasgow Corporation. It is intended to replace a 25-cycle machine which is now being dismantled. The alternator will generate three-phase current at a pressure of 6500 volts and will give the maximum continuous output mentioned

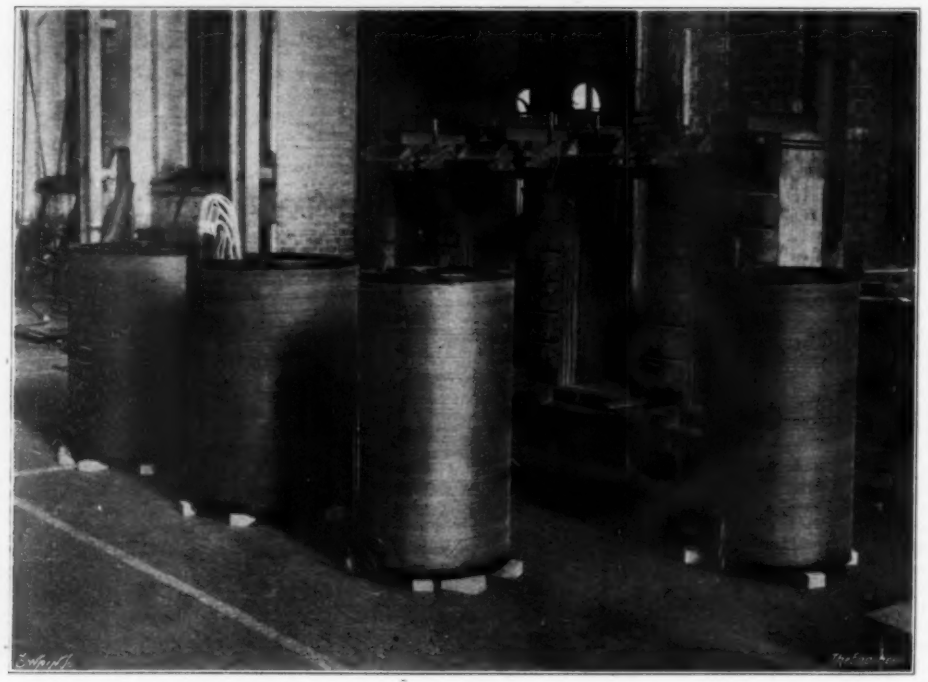


FIG. 15—9000 kVA SELF-COOLED TRANSFORMER FOR MANCHESTER

at 0·8 power factor with a temperature rise within the limits of the British Standard Specification 225, 1925. In the case of emergency it will give 34,400 kVA without dangerous heating. The speed is 1500 revolutions per minute. Among other turbo-alternators in the course of construction were a 15,625 kVA machine for the Wallasey Corporation, a 16,667 kVA machine for the Preston Corporation, and three 18,750 kVA machines for the St. George's Bay Power Station, Athens.

WATER TURBINE ALTERNATORS.

Three water turbine alternators for the Perak River Hydro-electric Company are at present going through the shops. One of these machines is shown in Fig. 14. They are being built for the Chenderoh power station and they are said to be the largest alternators of their type that have been made in this country. They are designed for coupling to vertical shaft reaction turbines developing 15,000 horse-power at 93·7 revolutions per minute; they will each have a normal output of 11,250 kVA at 0·8 power factor with an overload capacity of 12,350 kVA at 0·875 power factor and will generate three-phase, 50-cycle current at 6600 volts. The total weight of each machine exceeds 200 tons, the rotating parts alone weighing 90 tons with a fly-wheel effect of 12,500,000 lb.-ft.². The rotors are designed for an overspeed of 187 revolutions per minute. The rim carrying the poles is built up of steel laminations keyed to a central steel spider. The rotor is supported in a Michell type thrust bearing, mounted on a massive eight-arm upper bracket, while the lower bracket is designed to support the rotor during erection and carries separate braking and jacking cylinders. The total load to be carried by the thrust bearing, including the hydraulic thrust, is over 210 tons. These machines are the latest of a series of large water turbine alternators which the company has supplied for installation in many parts of the world.

WATER TURBINE DIRECT-CURRENT GENERATORS.

Some very interesting water turbine direct-current generators were seen in various stages of manufacture for the new hydro-electric power station at Lochaber, which was visited on the occasion of the recent meeting of the Institution of Electrical Engineers in Scotland. The complete order comprises five impulse turbines, each of 9600 horse-power and each driving two 3400-kW horizontal direct-current generators. The necessity for massive construction will be readily understood when it is stated that each machine has an output of 10,000 ampères at 300 volts, and has to run at practically full load throughout the year. Each machine has been designed to withstand an overspeed of 90 per cent..

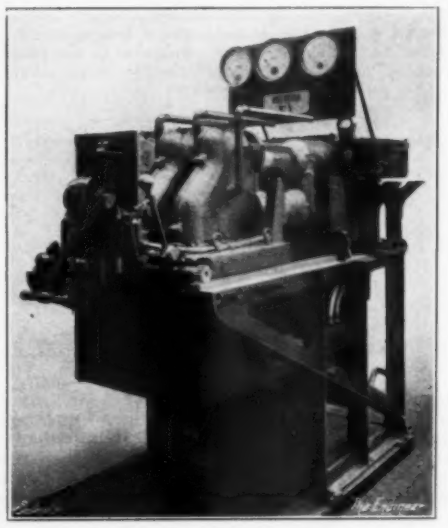


FIG. 16—METAL-CLAD COMPOUND-FILLED PILLARS

HIGH-FREQUENCY ALTERNATORS FOR INDUCTION FURNACES.

The company has given much attention to the design and manufacture of high-frequency alternators for induction furnaces, and, in the winding bay, stators and rotors for two 150-kW, 2200-cycle sets and a 650-kW, 1000-cycle set were nearing completion. The high peripheral speed of the rotors of these machines calls for the use of special bronze keys for retaining the pole coils in place, and manganese bronze end bells for the overhang of the windings. The 150-kW machines run at 3000 revolutions per minute. Axial ventilation is adopted and the rotor, although inherently of the salient pole type, resembles a small turbo-alternator. Mica is employed for

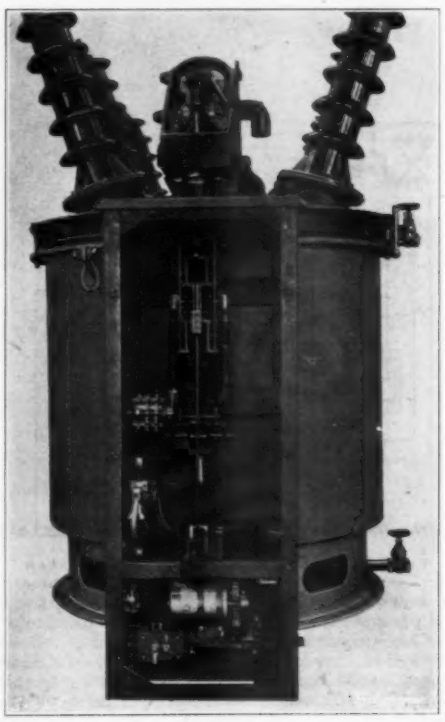


FIG. 17—MOTOR-OPERATED CIRCUIT BREAKER

insulating the rotor and stator coils. The stator frame of the driving motor and of the alternator for the 650-kW set are of the built-up type, a form of construction which has been adopted extensively in the United States. On the test bed there were two finished 150-kW high-frequency alternator sets, one designed for a speed of 3000 revolutions per minute and the other 1500 revolutions per minute. The latter is being supplied to a firm in the Birmingham district, where the frequency is 25 cycles per second, and it will be used for melting nickel alloys. The other machine will be employed for steel melting.

TRANSFORMERS.

One of the most interesting transformers brought to our notice during our tour through the transformer department was the 9000-kVA, three-phase, five-limb unit shown in Fig. 15. It is being built for the Manchester Corporation, and it is said to be the largest self-cooled transformer so far made in Great Britain. The English Electric Company's key bolt method of construction has been adopted, and the whole structure is solid and well braced. The key bolt scheme eliminates the use of tie bolts between the top and bottom yokes, thus removing the difficulties that arise in insulating these bolts where they pass close to high-tension windings. Among many other transformers going through the shops were some 132-kV units for the Central Scotland electricity scheme. Coils and other parts for the construction of eight three-phase units of 10,000 and 15,000 kVA capacity were seen in the course of manufacture.

FIG. 18—CUBICLE TRUCK-TYPE SWITCHGEAR

Notwithstanding the large size of these units, they are designed so that they can be transported from the works to the site in their own tanks and in oil. This eliminates the necessity of having to dry out and assemble the transformers on site and, needless to say, avoids much trouble and expense. The 132,000-volt windings will be star connected and the neutral point will be solidly connected to earth, thus allowing graded insulation to be adopted, which result in considerable economy. The low-tension windings will be connected in delta, and in order to provide a neutral a separate earthing reactor will be employed, which will also serve 440-volt mains for running auxiliary plant. Each transformer will have gear for tap changing under load and to give plus and minus 10 per cent. voltage variation. For a considerable proportion of the full load natural cooling will be relied upon, but at the heaviest loads an air blast will be directed on to the radiator tubes.

SWITCHGEAR.

All classes of switchgear, ranging from small panels for the control of small motors to equipments for the largest power stations, is manufactured. The department is also responsible for the automatic gear associated with automatic sub-stations. For testing and demonstrating purposes one of these stations has been erected in the works. The high-tension alternating-current control cubicle, step-down transformer, and cam shaft controller cabinet for this sub-station is shown in Fig. 3 on page 66. The rotary converter is a 1500-volt, 50-cycle machine, which is started on the tap changing principle. A direct-current exciter on the main shaft excites the field and also supplies current to a small direct-current motor which drives the cam shaft controller, consisting of cams operating contactors. The protective devices have their contacts connected in series with what is known as No. 1 protective circuit, so that unless this circuit is complete the main circuit breaker cannot close.

A very fair amount of compound-filled armour-clad switchgear was going through the works. This horizontal "draw-out" gear—see Fig. 16—is designed to give the highest degree of safety and all movements are interlocked. When the oil breaker unit is withdrawn it is isolated and the self-aligning contacts are automatically screened by shutters. All live parts are either immersed in oil or are surrounded by compound after they have been taped. The bus-bar chambers are filled with compound before the switches are dispatched. The switches are built on an adaptable unit system with single bus-bars or duplicate bus-bars with plug changing or interlocked oil-immersed selector switches. An interesting circuit breaker is shown in Fig. 17. The three-phase 100-kV circuit breaker is actuated by a direct-current motor operating gear worked by a 12-volt motor car starting battery. Attention may also be drawn to the large three-unit truck type switchboard shown in Fig. 18, which has a rupturing capacity of 250,000 kVA and is designed for use on systems working at pressures up to 13,000 volts. The oil-immersed circuit breakers may be designed for hand or electrical operation and both types of gear are shown in the illustration. Space is available on the front of the units for a large number of instruments and protective relays if required, whilst there is ample room within the trucks for two sets of current and potential transformers. Synchronising gear and metering cubicles can also be provided if necessary, so that homogeneous switchboards can be built up of truck units and accessories to meet practically all requirements. The trucks are mounted on wheels with ball bearings, so that in spite of their heavy weight it is an easy matter to run a truck out of its housing.

A Rock Drill Holder.

WE have received from Keith, Orme and Co., of 311, Fulwood-road, Sheffield, some particulars of a novel form of holder for rock-boring drills, which aims at eliminating the fatigue of the operator in holding the machine up to its work. Incidentally it enables one operator to attend to at least three drills at the same time.

The principle of the device is the utilisation of the vibration of the machine to feed the drill forward into the face. This is effected by means of the pawls and rack bars shown in the sketch—Fig. 1. The drill is mounted on a sledge A by means of a bracket B. This sledge slides on two angle bars C C, which are braced together by plates at short intervals. To the insides of the angle bars there are bolted the rack bars D D. The teeth of these bars have a pitch of five per inch, and are engaged by the pawls E E, which are of slightly different lengths, so that one pawl is in engagement while the other is half a tooth pitch in advance. The pawls are held up to their work by the spring F, and are provided with handles G G, so that they can be disengaged from the racks for the withdrawal of the drill.

The action of the device is fairly obvious, and all that is necessary to put it into operation is to push the drill up to the working face and turn on the compressed air. The recoil of the drill naturally produces a backward and forward vibration, but the pawls restrain the backward movement while they permit the sledge to go forward. The result is that the drill is steadily fed into the hole, and can be left to work by itself until the hole is drilled to the full depth. It is noteworthy that the rate of feed automatically adjusts itself to the hardness of the rock being drilled, so that the hole is made as fast as is possible. The arrangement also has the advantage that the feed is truly in line with the start of the hole, with the consequence that the hole is straight and broken drills are reduced to a minimum.

It is, of course, necessary to support the whole device at the face, and for this purpose the bar—shown in Fig. 3—is

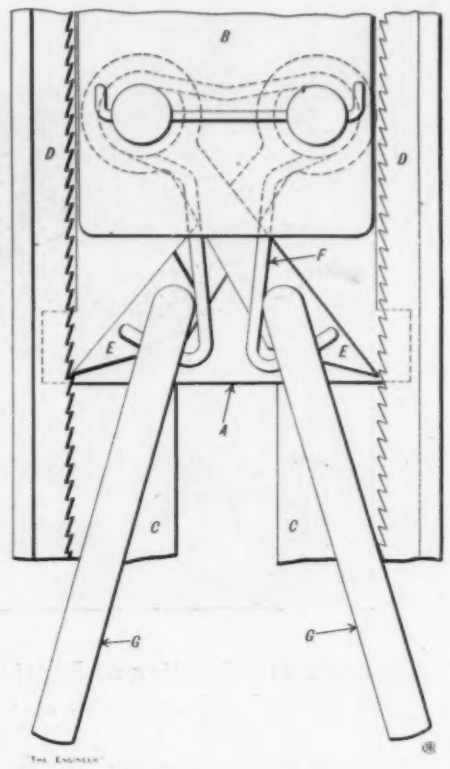


FIG. 1—KEITH-ORME ROCK DRILL HOLDER

employed. It is merely a short piece of octagon steel bar 1¼in. in diameter, with a barbed end, as shown, riveted to the front of the sledge runners. A hole is drilled in the rock face to a depth of from 4in. to 6in., according to the

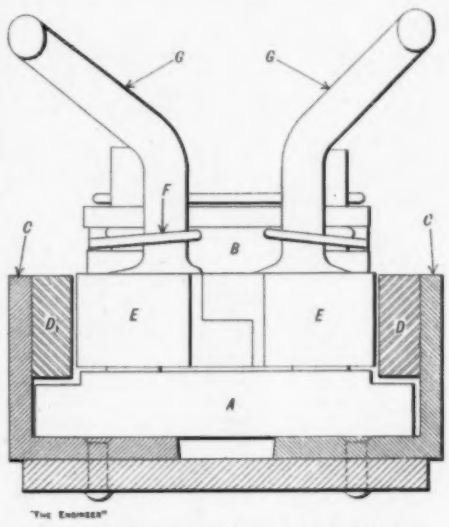


FIG. 2—CROSS SECTION OF DRILL HOLDER

strength of the rock, and the bar is inserted in this hole. The barb is pressed into engagement with the top of the hole by the weight of the machine, and a secure fixture is

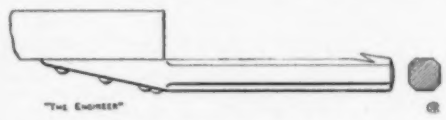


FIG. 3—SUPPORTING BAR

obtained. The weight of the holder, without a hammer drill, is 77 lb. It is made of wrought steel throughout, and has a length of 6ft.

THE MOTOR CAR FERRY "WOOTTON."—The motor car ferry "Wootton," which has been built by William Denny and Brothers, Ltd., of Dumbarton, to the order of the Southern Railway Company, has now been put into service between Portsmouth and the Isle of Wight. In design and equipment she is generally similiar to the "Fishbourne," which was described and illustrated in THE ENGINEER of July 22nd last. On the new ferry, however, the loading and unloading platforms are slightly longer, and they are electrically operated. Electrically driven deck warping captsans are also fitted, and the accommodation is electrically heated. The main engines comprise two sets of 120 B.H.P. Gardner heavy oil engines, with two 12½-kW paraffin engine-driven generator sets by the same makers. Before delivery, the "Wootton" ran successful trials on the Clyde, a speed of 8·7 knots being obtained.

TIN SMELTING FURNACE AT BOOTLE—FRONT VIEW

The Penpoll Tin Smelter at Bootle.

On Friday last Lord Derby performed the opening ceremony in connection with a new tin-smelting plant which has been erected at Bootle, Liverpool, for the Anglo-Oriental Mining Corporation, Ltd., Bishopsgate, London, E.C. 2. The plant is designed on the most modern lines and is claimed to be the largest in British ownership in Europe. It has been built to deal principally with British Empire tin. The smelting is subdivided into several processes. The tin ore is first taken to the roasting and leaching plants, where the impurities are removed. The roasting is carried out at a heat of 600 deg. to 700 deg. Cent., in oil-fired furnaces, before it is passed on to the leaching vats. After being roasted and purified, the ore is taken by an overhead railway and tipped into hoppers above the main furnaces, where it is subjected to a heat of 1250 deg. Cent. After several hours' treatment the tin in a molten condition is run off into a tapping kettle, whence it is ladled by hand into moulds, each containing about 112 lb. After cooling in the moulds the ingots are loaded into trucks and transported on a light railway to the refining furnaces, where the tin is re-melted at a low temperature, the refined tin emerging from the furnace being received by kettles of 10 and 5 tons capacity.

In these kettles the contents are kept in motion in order to bring the dross to the surface, where it is skimmed off by hand. The practically pure tin is then ladled into moulds to form ingots of 28 lb., 56 lb. and 100 lb. weight. An important feature of the Penpoll plant is the means provided to recover the metal from the smoke of the furnace. This is an electro-static apparatus which operates at a pressure of 100,000 volts, and it, it is stated, will save some 200 tons of tin per annum, or 2 per cent. of the total output.

We are informed that the capacity of the Bootle works is 1000 tons of tin ore per month, giving an output of 650 to 700 tons of tin of 99·95 per cent. purity. The present buildings cover just under 2½ acres, and they are arranged in such a way as to be readily extended when necessary.

American Engineering News.

Mechanical Casting of Pipe.

Substituting mechanical power for hand labour is the feature of a new process for making cast iron pipe, which has been put into operation recently at the McWane Foundry. Moulding sand from the shakers goes to screens, a pug mill, mixer, storage bins and conditioners, from which an underground belt conveyor delivers it to service bins at the rammers. As a mould is placed, sand is charged into it, rammed by a jolt machine, and then finished with pneumatic rammers. Each mould makes from two to six pipes 16ft. long, depending upon the diameter, which is from 4in. upward. An overhead travelling crane handles the copes and drags on the assembling floor. A similar crane takes the machine-made cores, places them in the drags, and carries the closed flasks to the casting floor. These cranes keep about six moulds ready in advance of the pouring machines. A curious feature is the use of multiple-lip ladles, each of which has fourteen spouts, and can pour two pipes at once. Another travelling crane handles the ladles and also places the moulds on a truck which carries them to the core-bar pulling machine. This crane also places the used copes and drags on a shake-out machine, the sand being carried back to the bins by a belt conveyor. After the core bars have been pulled the pipes go to large rattling or fettling machines, beyond which there is the usual inspection, hydraulic testing and dip coating. An entire unit of the plant produces a given size of pipe.

Detecting Defects in Rails.

An electric device which is attached to a permanent way inspection car and in passing over the line detects, records and marks the position of interior defects in the rails, has been perfected by the Sperry Rail Service Company, and has been given trial trips which indicate that with certain modifications in detail it will become a very valuable addition to track inspection equipment. In this machine, which is the invention of Mr. E. A. Sperry, inventor of the gyroscope, a current is made to flow through the rail between two sets of copper brushes which are held against the top of the rail head by springs. A small potential brush mounted between these main brushes picks up the difference in potential due to the resistance effect of the air gap at any internal break in the steel. A set of radio valves steps up this micro-voltage about 200,000 times. A relay device causes a jet of paint to be thrown on the rail at the point where this resistance occurs. On a table in the car travels a continuous sheet of paper, passing under a row of seven electrically-operated stylo pens. The middle pen marks the position of rail joints. Three pens on each side mark for one line of rail. If the internal defect of the rail is of small area, one pen makes a lateral offset on the straight line of the chart; two pens mark a break of medium size, and the three mark any large defect. As these invisible defects may develop under traffic until the rail breaks, this new device may prove of great value.

Diesel-Electric Tugs.

For two large tugs for the Panama Canal service, the power machinery consists in each case of two four-cycle six-cylinder Diesel engines of 480 H.P., at 257 revolutions directly connected to two 330-kW 250-volt generators with 50-kW 250-volt exciters. There is one main motor on the propeller shaft, with a normal rating of 750 H.P., but an overload capacity of 900 H.P. The speed range of the motor and propeller at full power is from 115 to 150 revolutions, with 25 speeds forward and 25 speeds astern. Operation is controlled from three stations; in the engine-room, the pilot house, and at the after end of the deck house. The steering gear, which is of the electric-hydraulic type, has 7½-kW motors, and at full speed of 13 knots it can put the rudder from hard-over to hard-over in 11 seconds. The boats can turn in a circle of 500ft. For fire-fighting, each boat has a revolving nozzle or monitor and a centrifugal pump delivering 1000 gallons per minute at 100 lb. pressure. An auxiliary Diesel-electric plant drives a compressor for charging tanks used in starting, the pressure in these tanks being maintained when the main engines are running by means of a motor-driven compressor. These tugs are of steel construction, 126ft. long, 28ft. beam and 15½ft. deep, with a mean draught of 13ft., and a loaded displacement of 623 tons. In view of the high atmospheric temperature and the frequent rain squalls, special ventilation is provided for the electrical machinery. Each boat has an electric automatic towing machine with an inhaul capacity of 75ft. per minute.

American Rolling Mill Practice.

A recent report on rail-mill practice shows that nearly two-thirds of the rails now made weigh 100 lb. to 135 lb. per yard. Open-hearth furnaces are being modified in design to give increased efficiency of combustion, while tar and oil are being used in some furnaces to increase the intensity of flame and to decrease the sulphur carried into the bath. Coating the inside of moulds with graphite and tar is found to prevent spattering metal from adhering and also to cause a smoother ingot surface, which in turn gives easier rolling conditions. With an increased silicon content in the steel, the use of aluminium to "kill" the steel in the moulds is being discontinued as unnecessary. For the moulds larger corner radii are being introduced, as this reduces the cracking of moulds and the weakness in sharp-cornered ingots. Reheating the blooms from the ingots before the blooms are rolled into rails, is becoming general practice. Changes are being made also in the design and material of the rolls, to increase their life by reducing wear and failure, and thus enabling rails to be rolled more exactly to the template. Hot saws are being improved to give a smooth finish on the rail end and reduce the size of saw burrs. Mechanical handling of rails on the hot beds, to promote uniform cooling, is found to reduce the work of straightening. Experiments are being made also with roller straightening presses, as in European practice. As to rail steel, there is increasing use of manganese in the metal and of heat-treatment of the finished rail. The standard length is now 39ft.

THE MOTOR YACHT NARCISSUS.

The yacht "Narcissus," which is owned by Captain C. O. Liddell, was built by the Fairfield Shipbuilding and Engineering Company, Ltd., in 1905, and her propelling machinery orginally comprised twin-screws direct driven by turbines of about 1500 S.H.P., which were designed to give a speed of 14·3 knots on trial. The yacht, which has an overall length of 223ft., with a beam of 27ft. 6in. and 11ft. draught when fully loaded, has recently been converted to motor propulsion by the installation of two 675 B.H.P. Sulzer two-stroke oil engines. The work of conversion was carried out at the Southampton Yard of Camper and Nicholson's, Ltd., and at the same time opportunity was taken to modernise the accommodation and to take in the space which has been made available by the installation of the more compact propelling machinery.

The two new engines have each six cylinders with a bore of 340 mm. and a stroke of 540 mm., and they are designed to develop their full output at 210 r.p.m. This speed is a little higher than that usually adopted in larger marine installations, and for that reason a longer piston-rod has been employed, and a gland fitted, which separates the crank chamber from the piston space. By this means the splashing of lubricating oil on the walls of the cylinder is claimed to be avoided.

The steam-driven auxiliary machinery has been retained for use at sea, and steam will be supplied by an oil-fired Cochran boiler. In order, however, that it may not be necessary always to keep this boiler alight, electrically-operated auxiliaries are to be used for part service. These include a direct-current generator set driven by a Gardner hot-bulb engine, which also drives a Reavell auxiliary air compressor through a clutch. The other auxiliary compressor is a steam-driven Reavell set.

Trials were carried out early in the month, when an average speed of 14·55 knots over the measured mile was maintained. The absence of vibration was, we are informed, commented upon, and during the slow running test the main engines worked steadily at 50 revolutions, which is less than one-quarter of their designed running speed.

VISIT TO HADFIELDS LTD.

On Wednesday last, Hadfields Ltd., entertained Mr. E. F. C. Trench, Mr. R. W. Morrison, Prime Warden of the Worshipful Company of Blacksmiths, and many other guests at the East Hecla Works. A party numbering between sixty and seventy travelled to Sheffield from London by special coaches reserved on the L. and N.E.R. (Great Central) Railway. On arrival the guests were received by Sir Robert Hadfield, Mr. P. B. Brown, Mr. W. B. Pickering, and other members of the staff. Luncheon was served immediately in the works dining room, and after the toast of "The King" had been honoured the Hadfield Glee Singers, conducted by Sir Henry Coward, sang a verse of the "Blacksmith's Song," which concludes with the motto of the Blacksmiths' Company, "By hammer and hand, all arts do stand." An encore being loudly demanded, another verse was sung. Sir Robert then rose to propose "The Guests." He said that whilst visitors would observe in their tour of the works that the firm was principally engaged upon peace products, yet it was still rendering services to the Army and Navy. After welcoming the President of the Institution of Civil Engineers, Sir Robert gave a brief outline of the history of the Blacksmiths' Company, which was founded in 1325 in the reign of Edward II., and extended a hearty welcome to its Prime Warden and Renter Warden. With the name of the guests he desired to couple also that of Mr. John Hodge. Brief replies were made by Mr. Trench, Mr. Morrison and Mr. Hodge, and a tour of the works was then made. A great many very interesting things were seen, for the works appeared to be busy in most departments; but special attention was, naturally, given to manganese steel, of which a number of remarkable castings, as well as rolled sections, were examined. The actual rolling of manganese steel bars was seen, and in the foundry two large medallions were cast. Later on the visitors had an opportunity of examining these medallions and admiring their cleanness and the accuracy with which the very hot metal had followed the smallest details of design. In the steel works and elsewhere in the shop were seen buckets and other parts for a huge ladder dredger, whilst an immense steel jaw crusher—the bed of which is a steel casting weighing upwards of 50 tons—for the Cauvery Metur irrigation scheme was a notable object in one of the shops, where various types of crushers were shown in operation. The great forging press for steel shell was also shown in action, and several members of the party fired a rifle at a Hadfield steel helmet. It is impossible to allude even briefly to the many other things that were to be seen, but the visitors could not fail to be impressed by the general air of activity which prevailed. On concluding the round of the works an inspection was made of a number of Bean cars of various types, passenger and commercial, and after a group photograph had been taken the London visitors returned to Marylebone in specially reserved coaches. The visit was favoured by excellent weather and was obviously enjoyed heartily by all.

The Thames Conservancy has decided to proceed with the construction of a dry dock at Riverside Works, Sunbury, at an estimated cost of £4500. This decision followed the consideration of a report as to difficulties at present experienced in the overhauling of tugs, launches, and other craft, owing to the lack of dry dock facilities on the river above Teddington.

B.E.S.A. Specifications.

TWIST AND STRAIGHT FLUTE DRILLS.

A BRITISH Standard Specification for Twist and Straight Flute Drills has just been issued by the British Engineering Standards Association. The specification contains tables giving the standard diameters, overall lengths and flute lengths for the various types of drills, and the dimensions of the Morse taper shanks. Standard limits are laid down for the permissible variation in the diameter of the drills and performance tests are specified for both carbon and high-speed drills from No. 60 to 2in. diameter inclusive. The performance tests consist in drilling a series of holes as continuously as possible in steel billets of a given analysis. The penetration per minute and the number and depth of the holes to be drilled are specified, but the revolutions per minute and the feed per revolution are left to the discretion of the maker. The drills must withstand these tests without seizing, choking or fusing, and the points of the drills and the lips must be in good condition and fit for further service without regrinding on completion of the tests. Standard nomenclature and definitions for the different types of drills in common use are also included in the specification.

SHIPS BOATS DAVITS AND STOWAGE.

THE British Engineering Standards Association has recently published a Specification for Ships Boats Davits and Stowage which covers all the gear required for the purpose of stowing and lowering of boats. Whilst the whole of the gear specified is efficient in every way and meets with the requirements of the Board of Trade and the register societies—whose representatives have co-operated in its preparation—the commercial aspect has not been lost sight of. The outstanding point in the specification is that the Board of Trade, at the request of the British Engineering Standards Association Committee, which drew up the specification, has amended the Life Saving Appliances Rules so that the same size blocks and falls used for lowering a 27ft. boat from a passenger ship may now be used for lowering a 30ft. boat from a cargo ship. This change affects all the smaller-sized ships boats in a like manner, and the same size gear may be used for lowering a 16ft. boat from a passenger vessel as for a 19ft. boat from a cargo ship. Hitherto it has been necessary for a cargo ship and passenger ship to have the same size blocks and falls to lower the same size of boat, although in the case of passenger ships provision has to be made for lowering boats with full complement of passengers, whilst in the case of cargo ships provision is only necessary for the crew. The adoption of this specification should mean a saving in the initial cost of fitting out cargo ships, which class of vessel represents about 80 per cent. of the British mercantile marine.

Copies of these specifications may be obtained from the Publications Department, British Engineering Standards Association, 28, Victoria-street, S.W. 1, price 2s. 2d. post free.

INDUSTRIAL WELFARE SOCIETY.

THE Industrial Welfare Society has arranged to hold a lecture conference at Balliol College, Oxford, from September 7th to 11th next.

The following is the provisional programme:—On Friday, September 7th, at 7.15 p.m. there will be a reception, followed by a dinner, after which an opening address will be delivered by Dr. James Baillie, LL.D., Vice-Chancellor, Leeds University.

On the Saturday, at 10.15 a.m., a lecture will be delivered by Mr. W. C. Warren, general secretary, the National Society of Electrotypers and Stereotypers, the subject being "A Joint Industrial Council in Operation." In the evening at eight o'clock, Mrs. Willson, President, Women's Engineering Society, Member of Women's Advisory Committee, I.W.S., will lecture on "A Comparison of Working Conditions in the Nineteenth and Twentieth Centuries." On the Sunday, after a short service at 10.15 a.m., Principal L. P. Jacks, of Manchester College, Oxford, will lecture on "The Ethics of Leisure." In the afternoon at 4.30 o'clock a lecture will be delivered by Mr. M. R. K. Burge—London Correspondent, International Labour Office—on "International Aspects of Welfare Work." At 8 p.m. a lecture will be delivered by Miss C. Haslett, director, Electrical Association for Women, Member of I.W.S. Council, on "Incentives in Industry."

On the Monday at 10.15 a.m., there is to be a lecture by Dr. Millais Culpin, F.R.C.S., Lecturer, London Hospital Medical College, and Research Worker, Industrial Fatigue Research Board, on "Nervous Disease and its Significance in Industry," and in the afternoon at 2.30 a lecture by Mr. H. Hamilton Fyfe, on "The Place of Comradeship in Welfare Work."

On Tuesday, September 11th, visits will be paid to the works of Charles Early and Co., Ltd., Witney, and of Morris Motors (1926), Ltd.

TWENTY-FIVE YEARS OF TURBINE CONSTRUCTION.—The July number of the *A.E.G. Mitteilungen* takes the form of an illustrated review of the progress made in turbine construction during the last twenty-five years. In the first article Dipl.-Ing. H. Treitel traces the evolution of the A.E.G. turbine from the earliest experiments to the large 50,000-kW generator units of present-day design. A summary is also given of the principal improvements made along with a list of the more notable types of installations built for power stations, pumping plants and ship propulsion. There are two articles by Professor Dr.-Ing. E. A. Kraft, the first, on the manufacture of turbines and gearing and their running in service, and the second on the development of the A.E.G. marine type of turbine. Th. Stein describes a 1700 lb. pressure power station for the brown coal industry; while Dr.-Ing. H. Albrecht writes on the use of feed heating in modern turbine practice. Air coolers for turbo-generators are dealt with by Dr. R. Pohl, and Th. Stein describes the influence of A.E.G. turbine development on the economics of generation and distribution in Germany. Finally, there is a short article by Dipl.-Ing. H. Hansen on small steam turbines for locomotive lighting. In accordance with usual practice, an English edition of this journal will be published at a somewhat later date.

Provincial Letters.

THE MIDLANDS AND STAFFORDSHIRE.

(From our own Correspondent.)

Conditions Unchanged.

No development of business has marked the opening of the new quarter, last week's quarterly meeting of the Midland iron trade having failed to produce any stimulating effect or any great weight of orders. In the engineering trades of the district and the various manufacturing industries which provide the Midland market for iron and steel, the reserve of work in hand is small, and there is much idle plant in practically every industry. Material supplies are so far out of adjustment with demand that prices are uncertain. Under these circumstances buying is cautiously undertaken, and tonnages are kept down to the lowest working limit. There is some competition for the business available, but it is less keen than it was, many ironmasters having refused to go any further in the matter of price concessions. The encouraging item of the week, and one which has called for much comment hereabouts, is the improved trade returns for the month of June. The production figures, showing a smaller output of iron and steel proved most disappointing, but it is clear from the Board of Trade returns that there has been a certain reversal in the currents of trade. Exports of manufactured goods increased and imports of iron and steel were reduced. This has encouraged hopes that home products are getting the ascendancy over imported iron and steel, and that as old contracts placed with foreign firms are worked off they will not be replaced, at any rate to the same extent, on the former scale. It is remarked that the total quantity of iron and steel imported during June was 210,405 tons, compared with 332,637 tons in the corresponding month of last year. For the year to date the quantity imported was 1,542,299 tons, compared with 2,570,271 tons in the preceding year.

Raw Iron.

The pig iron market is a source of anxiety with prices weak and buying on a small scale. Demand shows no improvement. Apart from the requirements of mills affiliated with the furnaces, there is scarcely any call for pig iron, though importation has been brought nearer to the vanishing point than for a long time past. The slump in consumptive demand at home has already lasted so long as to confound all calculations, and nobody can see where a new impulse is to come from. Midland furnace men have done a little, but only a little export trade. Supply continues in excess of demand, and stocks at the furnaces are increasing. Efforts which have been made to steady prices appear to have met with little success, large producers evidently not considering it to their advantage to agree upon a common basis price. There are a few Midland blast-furnacemen, however, who blankly refuse to accept the specially low prices at which business has been taken by some sellers. It would appear that on the Birmingham market consumers are not disposed to make bids. They leave the initiative with the seller. The prices quoted this week are much as last. For Derbyshire No. 3, £3 to £3 1s. was asked, and for Northamptonshire, £2 16s. to £2 17s. Forge iron values are indeterminate. North Staffordshire, a special type of limited production, is 1s. dearer at £3 3s. 6d. Cold-blast iron is also meeting with a good demand for roll casting, the selling price of the material being £9 10s. District plants engaged in the production of basic pig for associated enterprises have been going steadily. Some stimulus has been felt in this department as a result of the turnover of trade in billets and blooms, strip and bars, from the Continent to mills at home.

Steel.

The Midland steel trade does not show any real development, even though the high continental rates of finished steel and semis have had the effect of diverting orders to native steelmakers. A not inconsiderable amount of continental steel, including both semis and finished products, is still coming in. The trade returns for the month of June provide evidence that the home producer is consolidating the gains which changing circumstances have given him. The somewhat easier prices which have been quoted in Birmingham during the past fortnight for foreign material have not appreciably affected the increased share of the trade which native makers are getting. In this district the demand for structural material has been stimulated by some good contracts which have been placed within the last month or two, and most of the plants are in regular operation. Although finished steel prices are unchanged, the tendency of prices is in the upward direction. A small but somewhat significant matter is the decision of steelworks to raise their extras for what is called simple labour in the preparation of structural material. For billets the re-rollers and producers of finished material generally now go to the British steelworks, and some works have quite good orders for billets, bars, slabs, blooms, &c. The price for billets continues at £6 as a basis, but an increasing proportion of sellers charge £6 5s., and for the first time over a long period £6 7s. 6d. has been paid this week. This was an order wanted urgently within seven days, and the customers had to pay an extra 2s. 6d. for getting preferential treatment. Wire rods have been increased in price as the result of the inability to obtain continental supplies. The charge for this material is £9 10s. to £9 15s. Steel strip is in fairly good request at £7 10s. per ton.

Finished Iron.

Trade in the finished iron industry continues slowly to progress, and the market position is unchanged from a week ago. Makers of marked bars are working more regularly than for some time. Supplies continue to be offered at the existing basis of £12. Latterly there has been some falling off in the demand for chain and cable iron, but this is probably no more than a passing phase. Producers of medium material are increasingly active, but there is considerable disparity in the rates at which Crown iron is offered. The range is from £9 5s. to £10. Some of the Lancashire makers report a fair amount of business with South Africa, but generally the export trade is poor. The Black Country mills continue to benefit by the transfer of orders from foreign to home mills. In the nut and bolt trade a good deal of ¼in. iron has been bought from abroad at the rather attractive price of £6 10s., but Belgium, owing to shortage of supplies, lately increased the figure to £10, and this has sufficed to transfer the business to Black Country mills willing to accept it at the same price. The iron strip trade is somewhat slack, and competition for the small orders going is correspondingly keen. Values range between £10 15s. to £10 17s. 6d. At last week's quarterly meeting it was reported that there was little evidence of any definite reanimation of other branches of industry on which the bar mills depend.

Galvanised Sheets.

The galvanised sheet trade is more active than it was, but manufacturers are not so strongly placed that they can in all cases enforce the advance to £13 10s. that was attempted last week. A certain amount of business is being negotiated at that figure, and mills with good order books refuse to shade it, but in a large number of cases firms cannot afford to lose orders by adherence to this figure, and they accept half-a-crown less, viz., £13 7s. 6d. per ton for corrugated sheets of 24-gauge.

Tin-plate.

Though the tin-plate trade in this district has improved during the past quarter, home demand at the moment is quiet. Good forward sales on export account have given fresh confidence to producers, however, and a premium of 1s. is demanded on the basis of 17s. 4½d. Recent application of price control to wasters, odd sizes and smalls has checked business in this district, consumers refusing to concede the high rate which has been decreed.

Scrap.

There is a continued demand for scrap, and the market has been further strengthened by some purchases from Germany. Heavy steel scrap commands £3 7s. 6d. to £3 10s. delivered South Wales.

Discouraging Statistics.

It is regrettable to find that last month's production of pig iron and steel provided a continuance of the discouraging record which has been in progress almost since the beginning of the year. Pig iron output was 563,700 tons, being 27,800 tons less than in the previous month, and 87,600 tons less than in June of last year. The output of steel ingots and castings was 709,500 tons, being 43,200 tons less than in May, and 37,800 tons less than in June of last year. Of the two sets of figures, that relating to steel production is the most discouraging, since the reduced foreign competition should have had its counterpart in larger British output. The smallness of the individual orders is said to be mainly accountable for the comparatively poor return, as the frequent roll changing makes it impossible for the powerful modern machinery to give an equivalent output. It is of interest, as showing the trend of events in the raw iron department, that there are seven fewer furnaces in blast, ten having been put out of action and three having been lighted during the month.

New Staffordshire Industry.

South Staffordshire's newest industry, the manufacture of tires, as carried on at the Rushbury, Wolverhampton factory of the Goodyear Tire and Rubber Company (Great Britain), 1927, Ltd., differs in its processes from any of the industries already established in the district. Production on three eight-hour shifts, allowing for continuous operations, has been going on since April, and the factory is now turning out 2300 tires and tubes a day. The operatives have rapidly assimilated the methods of a new and skilled industry, and the firm has nothing but praise for the manner in which local workers have taken their place in a factory in which the processes are entirely new to them. Some 1300 men and girls are now working full time. The factory has been established on a site formerly occupied by a hollowware works. Employees have ample working and breathing space, and are thus enabled to carry out their tasks under the best possible conditions.

LANCASHIRE.

(From our own Correspondents.)

MANCHESTER.

Textile Machinery for Abroad.

IF British engineering firms engaged in the manufacture of textile machinery have much of which to complain concerning the condition of the home market for their products, except, perhaps, in the case of plant for the manufacture of artificial silk, they have less ground for complaint in respect of overseas markets. The total exports last month reached 12,281 tons, of an aggregate value of £1,135,501, made up of 8971 tons of spinning and twisting machinery, valued at £859,945, 2861 tons of weaving machinery valued at £203,023, and 449 tons of other descriptions of textile plant of a value of £72,533. In the corresponding period of last year shipments abroad were valued at £924,343, and in June, 1926, at £791,711. British India continues to be the most important market for textile machinery exported from this country, shipments thence last month reaching a value of £244,440. Russia came next with £198,602, compared with only £8326 in May last, the increase to that country being responsible in a large measure for the improved total. Germany was third in importance, with £94,740; followed by the Netherlands, with £78,500; Japan, with £68,176; South America, with £55,685; France, with £54,706; the United States, with £35,013; Australia, with £19,156;

and China, with £17,532; "other European countries" taking shipments to the total value of £222,549.

A Satisfactory Half-year.

With the June exports well above the average for the preceding five months of the current year, textile engineers have enjoyed a satisfactory period of trade in the export branch during the past six months. Altogether, 62,845 tons have been shipped, valued at £6,017,790, compared with 57,233 tons and £5,609,036 in the first half of last year, and 50,780 tons and £4,926,066 in the corresponding period of 1926. British India took exports valued at £1,370,341; Russia, £598,377; Germany, £539,544; Japan, £414,615; the Netherlands, £398,771; France, £345,002; South America, £304,609; the United States, £245,032; Australia, £94,940; and China, £72,742; "other European countries" being responsible for an aggregate of £1,342,305.

Super-Power Stations and Crops.

In view of present-day developments in central power schemes, a case which occupied the Civil Court at Manchester Assizes in the early days of this week, and in which judgment was given on Tuesday, will be of very great interest to electrical undertakings throughout the country. Briefly, the case was one in which the Manchester Corporation was sued by a farmer for alleged damage to crops on land in the vicinity of the Barton electricity works. On behalf of the plaintiff, who also applied for an injunction, it was stated that the coal consumption at the Barton station, which was erected by the Corporation in 1923, was between 550 and 560 tons a day, which meant a daily discharge of sulphur in one form or another of about 11 tons. By increasing the height of the chimneys from time to time, the crop damage caused by the sulphur fumes had been reduced, though plaintiff's counsel asserted that the effect had been negatived by the fact that other chimneys were built, there being twelve chimneys in all, which were not a great height above the level of the roof. The fumes were blown along the ground, and the effect on the vegetation in the surrounding country was plain to be seen, the trouble, it was alleged, having only been experienced since 1924. For the defence it was claimed that the Corporation was entitled in this matter to be a nuisance, and in support of this contention counsel cited provisions in the Act of 1914. It admitted that the works had added materially to the discomfort of the area. Evidence given by Mr. H. C. Lamb, chief engineer and manager of the Manchester Corporation electricity department, was to the effect that the chimneys of the Barton power station had been raised twice, and after that there were still complaints, though not so many. Mr. Lamb asserted that it was not possible to generate electricity or create power by burning coal without sending sulphur dioxide into the air. The water supply and facilities for cheap transport of coal were, he said, important considerations in selecting Barton for the works. When the works were built it was not anticipated that any harm would be done to the plaintiff's farm. Expert evidence for the defence was that the nuisance could not be mitigated. Mr. Justice Talbot gave judgment for the Corporation, but made no order as to costs. The defendants were entitled, he said, to succeed on the ground that the nuisance, which otherwise would have been objectionable, had been authorised by Parliament.

Another Joint Electricity Board.

Under the Stretford and District Electricity Bill, which has been before the Unopposed Bills Committee of the House of Commons, it is proposed to constitute a joint electricity board of the local authorities of Stretford, Urmston and Barton-upon-Irwell, and to vest in the board the electricity undertakings of the Stretford Urban District Council and the undertakings of the Barton and Urmston Electricity Board. The combined areas will represent a rateable value of £735,000 and an acreage of 10,000. A large industrial demand for electricity already exists in the Stretford area.

Non-ferrous Metals.

On the whole, the market for non-ferrous metals during the past week has been an uneventful one. Statistical conditions rather than any marked improvement at the consuming end, the demand for the metal having continued on somewhat moderate lines, have helped towards a further recovery in tin prices following the severe slump throughout last month, with values at the moment of writing £4 a ton better than they were a week ago, or about equal to the ruling quotations at the middle of June. There has also been only a comparatively quiet business done in the copper section. In spite, however, of a slight shading of the prices of standard brands of the metal compared with a week ago, the view of holders on this market is that the undertone is still undoubtedly a strong one so far as can be seen at the moment, at all events, and this is reflected in renewed firmness in electrolytic. Sluggish buying interest in the spelter section has had a markedly weakening influence on prices during the week and on balance there has been a relatively heavy loss, current values being at a new low record for the present year. There has been a moderate trade call for lead, and values have been maintained.

Iron.

Pig iron prices on this market have about held their own in spite of a persistently poor demand for Derbyshire and Staffordshire descriptions, which normally enjoy the bulk of the trade in this part of the country. The view of sellers is that the tone is steadier, although so far there has been no appreciable effect on quotations. The fact is, of course, that the market is at one of its quietest periods, and the probability is that even a moderate improvement in the volume of buying after the holidays will serve to raise prices to some extent above their present relatively low levels. Derbyshire makers are endeavouring to secure a minimum of 68s. 6d. per ton for delivery Manchester or equal distance, with Staffordshire brands obtainable at a slightly lower figure than this. Middlesbrough iron keeps up in the neighbourhood of 79s. per ton, delivered Lancashire, with Scottish at from 87s. 6d. up to 90s. in some cases, and hematite at 82s. Local makers of bar iron are unable to report any improvement in conditions, but they are not disposed to give way so far as prices are concerned, £10 per ton still being asked for Crown bars and £9 10s. for seconds.

Steel.

One of the largest rolling mill firms selling on the Manchester market reports having received several satisfactory specifications for steel materials, including large bars and tank plates. On the whole, however, business in the aggregate is of moderate volume, and although Lancashire constructional engineers continue to place orders for fair tonnages, there is room for considerable improvement in this respect. Boiler plates are quiet just now, and there is comparatively little inquiry either from boiler makers or locomotive builders. Offers of boiler plates this week have been at £9 10s. for basic kinds and £9 15s. for acid plates. Joists and sections are firm at £7 17s. 6d., general plates at £8 12s. 6d., small re-rolled bars at up to £7 15s., and large bars at £8 17s. 6d. Demand for imported steel materials is anything but brisk at the moment, with continental angles for delivery to Lancashire works quoted at about £6 12s. 6d. per ton, joists at £5 17s. 6d. to £6, Siemens plates at £7 17s. 6d., wire rods at up to £6 17s. 6d., steel bars at £6 12s. 6d. to £6 15s., billets at about £5 7s. 6d., and sheet bars at £5 10s. to £5 12s. 6d. per ton.

BARROW-IN-FURNESS.

General Conditions.

Business in West Coast iron continues to be very quiet all round. The requirements on general home account are limited, and there is no disposition to place contracts more than to cover immediate wants. Business, therefore, is from hand to mouth. For overseas trade, the business done is in small lots of special iron for the Continent. So far as local trade is concerned, steel makers are practically out of the market, with the chief mills idle. There are eleven furnaces operating, production exceeds consumption, and a cutting down of output can be looked for. The demand for hematite iron ore is largely local, but East Coast smelters are taking a certain amount of high-grade ores from Cumberland. Foreign importations are quiet. There is a very unsatisfactory state of things in the steel trade. The call for steel rails, the chief product, is not sufficient to justify makers in opening their mills. There is activity in hoop rolling at Barrow, and some small departments are engaged at Workington. Coal and coke are in fair demand. The shipbuilding and engineering trades are well employed in most departments, particularly engineering. New shipbuilding tonnage is in very quiet demand.

SHEFFIELD.

(From our own Correspondent.)

Heavy Steel Branches.

THERE is no evidence of a buying movement in the heavy iron and steel branches, and trade drags along in a most depressing manner. In the case of both crude steel and pig iron the tendency seems to be for orders to decline, and although there are fewer open-hearth steel furnaces operating now than before the stoppage for the half-yearly stocktaking at the end of July, it is not proving an easy matter to get rid of the output. There is an almost complete absence of forward buying. Users display no confidence and very little interest, and appear to be content to buy in small lots as required. The steel rollers are passing through a difficult time, and it is impossible to map out work profitably with little more than a mass of oddments to manipulate. Heavy engineering work is distinctly scarce, though a hopeful sign is that several important works, while far from busy, report that they have more work in hand than they had at this time last year. The amount of railway material going out of the city and district is poor. Conditions are just as depressing in the market for pig iron. There has been no change in the quantity of material being turned out, and with several important foundry users having been forced to curtail production, stocks of pig iron threaten to accumulate at several of the furnaces. As in the case of steel, there is no indication of a forward buying movement developing, and although official quotations are nominally unchanged, there is no difficulty in obtaining concessions for a useful order.

Special Quality Steels.

Trade in special steels furnishes one of the bright spots in local industry at the present time. There is no slacking off in research work, and although engineers continue to place stiffer and stiffer problems before the steel makers, it is very seldom that the latter fail to provide a satisfactory solution. A good deal of tool steel is finding its way abroad and the Dominions are proving particularly good buyers. In overseas markets generally, in fact, Sheffield-made material is more than holding its own in competition with foreign products, despite the fact that the latter usually have an advantage in the matter of price. Extremely satisfactory progress is being made with stainless steel, which is being more and more widely adapted to engineering work on a large scale. Work in these departments is steadily increasing.

Stainless Steel Chain.

Brown Bayley's Steel Works, Sheffield, have practically completed the manufacture of the huge stainless steel chain which is to be used for strengthening the dome of St. Paul's Cathedral, London. The chain, which will girdle the dome at the base of the Whispering Gallery, weighs 30 tons, and is 450ft. long. Each link is composed of three or four solid bars, 14ft. 8in. long. The operation of fixing the chain on the dome will be undertaken in the course of a few weeks.

Cutlery and Plate.

Very little fresh work for the cutlery and plate trades is being placed in the city. The seasonal holiday trade, although proving fairly satisfactory, cannot be said to be up to expectations, and with many houses holding pretty large stocks, actual working orders have not been materially increased. There is a very ready sale of stainless cutlery in the cheaper lines, and a good deal of good-class work is being turned out in the city for shipping, hotel and restaurant companies. Business is very quiet in scissors, pen and pocket knives, but the drop in trade in the old-style razor has been largely compensated by the big development in the production of safety razor steel and blades.

Foreign Cutlery Exhibition.

An interesting collection of foreign-made cutlery and tools was exhibited at the premises of the Sheffield Chamber of Commerce this week in conjunction with the Department of Overseas Trade. Among the patterns shown were pocket knives, scissors, razors, safety razor blades, skinning and paring knives, cooks' and butchers' knives, and steels from New Zealand; safety razor blades from Norway, Argentine, and Brazil; twist drills and hack saws from France. All these goods represented lines which are being marketed successfully in the above countries by German, American, French, Swedish, Norwegian, and Italian manufacturers. Every sample was labelled with the wholesale selling price, terms of credit, and date of purchase, while other valuable data regarding the extent of demand and the nature of competition to be faced in the various markets was available in the form of reports. Great Britain enjoys the bulk of New Zealand's cutlery trade, but Germany is making a keen bid for the business, and it is very necessary for Sheffield firms to keep a close watch on the activities of that country. With regard to the trade in safety razor blades, both in New Zealand and the other markets from which competitive samples have been obtained, Great Britain's position is not so strong and opportunities undoubtedly exist for increased British trade.

Closing of a Colliery.

In connection with the closing of the Hoyland Silkstone Colliery, near Barnsley, which gave employment to more than 1200 men, Mr. W. Hay, general manager and director, has written to the local Council to the effect that although the pit had been closed for the erection of new headstocks, with the intention of resuming when the work had been completed, the company, owing to trade depression, could now hold out no hope that the pit would be restarted this year. Miners who had worked at the pit were therefore advised to seek employment elsewhere.

Electricity Agreement.

Gainsborough Urban Council has approved an agreement with the Yorkshire Electric Power Company for a bulk supply of electrical current. This means that, subject to the approval of the Electricity Commissioners, the Council will continue to operate its own generating station, but will purchase from the company electricity, as required, over the amount which the Gainsborough station is capable of generating. The arrangement is in keeping with the Government's policy towards small generating stations, and in his explanation of the agreement, Mr. H. Haigh, the electrical engineer, states that the terms are such as the Council cannot hope to improve upon by adding further plant to its own station.

NORTH OF ENGLAND.

(From our own Correspondent.)

Cleveland Iron Trade.

THE Cleveland pig iron trade presents no new features of moment. Inquiries continue few, and the discouraging outlook is causing considerable anxiety. Just at present there seems little likelihood of material expansion of demand until September, when, in the ordinary course, negotiations to cover autumn requirements should open out. In the meantime consumers continue disinclined to purchase more iron than is essential for early requirements; but while little new business is passing, producers are able to maintain the fixed market rates of the past few months. Certain quarters usually supplied from this district are, however, taking the comparatively cheap iron of other areas. Stocks of Cleveland pig iron keep low, and the restricted output is well taken up, largely by makers' own consuming plant. No. 1 Cleveland foundry iron is 68s. 6d.; No. 3 G.M.B., 66s.; No. 4, foundry, 65s.; and No. 4 forge, 64s. 6d.

Hematite Pig Iron.

In the East Coast hematite pig iron branch, steady addition to the already rather large stocks is hampering trade. Producers are very anxious to avoid putting furnaces out of blast, and are consequently ready to accept orders at well below cost. Nearly all customers stipulate for iron made to special analysis to suit their particular needs, but values are still governed by the quotation for mixed numbers, which may be given at 68s. 6d. to 69s. Hematite is thus barely 3s. above No. 3 Cleveland, whereas the pre-war normal difference was 8s. to 10s.

Ironmaking Materials.

Transactions in foreign ore are almost unheard of, consumers being as disinclined as ever to negotiate for supplies, though merchants are emphatic in their declaration that values will move up as the result of shortage of ore. Best Rubio ore is fully 22s. 6d. per ton c.i.f. Tees. Blast-furnace coke is in only moderate request for local use, but export demand continues fairly large. Good medium sorts are 17s. 6d. to 17s. 9d. per ton delivered at the works.

Manufactured Iron and Steel.

Very quiet conditions prevail in the manufactured iron and steel trade. A good deal of semi-finished steel is being turned out, and producers report an odd order or two, but keener continental competition is threatened, with a noticeable cheapening tendency of overseas products. Finished steel manufacturers experience difficulty in inducing customers to negotiate for supplies, notwithstanding the inability of producers abroad to accept orders except for delivery well ahead. Quotations are unchanged.

Shipbuilding Orders.

Shipbuilding prospects on the North-East Coast have brightened this week as the result of the placing of several new orders, while a number of inquiries for new tonnage are reported to be circulating. The Swedish Lloyd Steamship Company, of Gothenburg, has placed an order with Swan, Hunter and Wigham Richardson, Ltd., for two fast passenger steamers for its line between Gothenburg and London. The vessels, which are to be delivered in May, 1929, will have the following dimensions :—337ft. overall by 50ft. by 32ft. moulded depth ; deadweight, 2430 tons ; draught, 20ft. 4in.; capacity, 142,000 cubic feet, of which about 6500 cubic feet will be refrigerated space for the transport of perishable cargo. The vessels will have single-screw Parsons turbine machinery, designed to give a speed of 17 knots on service. They will be the largest passenger steamers employed on the North Sea, and the new service, it is said, will, as far as Sweden-Finland-London is concerned, be not only the quickest, except flying, but also the cheapest. A continental firm of owners has placed an order with William Gray and Co., Ltd., West Hartlepool, for a steamer of 8500 tons deadweight. The vessel, which will be 405ft. long, is to be built at the Central Shipyard, West Hartlepool, and her engines will be constructed at the Marine Engine Works of the builders at West Hartlepool.

The Coal Trade.

Although a good many of the collieries in both Durham and Northumberland are working irregularly, particularly in the steams section, there are others which have sold large quantities forward—coking coal, for example, well into next year. In this business there has been no cutting of prices, thus showing how successfully —in a measure, at least—Northern coal is competing abroad. At the moment, the rising tendency in freights, due to so many boats being delayed through labour troubles at Finnish ports, and the higher rates conceded in most directions, have had the effect of impeding the regular stemming of vessels. Thus colliery clearances are not so rapid as they might be. Apart from this transient difficulty, the general coal position seems to be rather better. There is more inquiry about, and sellers are holding full late values. The forward market gives encouraging prospects of a slow but steady improvement in the demand, and as soon as tonnage supplies become more abundant, prices of all descriptions are expected to harden. Best Northumberland steams are offered at 13s. 6d., and seconds at 12s. The gas coal trade is somewhat irregular. Best qualities are well booked for prompt, but freely offered forward at recent prices of 14s. 9d. Durham coking unscreened are steady in anticipation of improved continental demands. Prices are unchanged at 13s. 3d. to 13s. 9d. An interesting development, as far as the Durham coking coal trade is concerned, is the fact that by the end of the year the new by-product works of the Consett Iron Company, at Derwenthaugh, should be in operation and take up a good share of that company's output of coking coal. Durham unscreened bunkers are quietly steady for best and superior classes at 13s. 9d. to 14s. 9d., but easy for ordinary qualities at 13s. to 13s. 6d. The prompt position for all makes of coke is quiet, and under abundant stocks prices are just steady. Forward there is a good tone, as continental demands are expected to show a substantial increase, and tonnage supplies to become more available. Gas coke is 20s. to 20s. 6d., patent oven cokes 18s. to 19s., and special cokes 23s. to 27s.

SCOTLAND.

(From our own Correspondent.)

"Fair" Holidays.

THE industrial holiday season in Scotland has commenced. On Thurdsay of last week the works in the West of Scotland, or at least most of them, ceased work, and the other districts will follow suit within the next week or two. The collieries are now on holiday. Owing to the general depression the usual holiday vacation will, in many instances, be extended to a fortnight at least.

Steel and Iron.

Until the stoppage, conditions in the steel and iron trades showed no change. Customers have been buying even more sparingly of late in order to minimise stocks for inventory purposes, and business, in consequence, has been more restricted than usual. It is expected , however, that the accumulation of orders during the stoppage will be large enough to insure a good restart when the works are reopened. The inquiry for steel sheets has improved a little during recent weeks, and corrugated galvanised varieties are a shade firmer. The bar iron works are poorly supported, and even if the re-rolled steel departments are a shade better off they cannot be termed busy. Pig iron is very dull, and a further reduction of output is probable. All prices are unchanged.

Exports and Imports.

During the past week 10,000 tons of iron ore and a small quantity of steel and iron from Welsh ports were unloaded at Glasgow Harbour, and 500 tons of pig iron at Bowling. Owing to labour troubles no continental material was handled. Shipments of steel and materials amounted to 4200 tons, and pig iron to 1606 tons during the past week.

Coal.

For a few days prior to the stoppage for the holidays the turnover in the export market was almost entirely confined to small lots required to finish steamers at the loading ports. No undue pressure for supplies was experienced. Likewise, the home market was without stir, as many of the largest consumers were due to close for holidays at the same time as the collieries, while requirements for utility works are at their lowest for the season. Under the circumstances prices are all nominally unchanged.

WALES AND ADJOINING COUNTIES.

(From our own Correspondent.)

Coal Trade Conditions.

IT is difficult to preserve an optimistic outlook in the face of so many depressing factors when the conditions governing the coal trade are considered. It is questionable whether the position is quite as satisfactory as it was a week ago. Certainly there is no improvement so far as the general demand from abroad is concerned. although the tonnage situation is a shade better. At the end of last week the total number of idle tipping appliances was thirty-six, whereas, as the result of arrivals over the week-end, this figure was reduced to twenty-four on Monday. Shipments last week came to only 296,055 tons, as against 345,057 tons the preceding week. This total is well below the average and more like half a million tons weekly is required to impart any real activity to shipments. Hopes are entertained that the returns for the current week will be somewhat better, but there are doubts whether shipments will register any marked improvement as chartering of late has been at a rather low level. Furthermore, merchants continue to experience great difficulty in securing the tonnage they require for the orders which they have in hand. This is shown by the fact that outward rates of freight are still firm, and for some directions are likely to go higher, much to the dismay of those exporters who have taken c.i.f. risks, and who, so far as freight rates are concerned, have based on too low figures. At the same time it is just possible that the improvement in outward freights may not last for long unless business comes along more freely than is the case just now. While the current demand for coals leaves much to be desired, there is not much that is fresh from the contract point of view. The Transatlantique Shipping Company is reported to be inquiring for supplies of about 30,000 tons of large coals for delivery over six months, or alternatively 60,000 tons over twelve months, while the Andalucian Railways of Spain are in the market for 11,000 tons of large coals for delivery over August, September and October. This is c.i.f. business, and, like all other Spanish business, the competition will be extremely keen.

Spanish Coal Restrictions.

Reference has been made to the action which has been taken by Spain adversely affecting the export of coals from the United Kingdom to that country. Protests have been made from time to time but without satisfactory results. Details have now been received of the Spanish Government Decree which was issued on Monday in last week, and which creates a Barcelona Syndicate for the distribution of all coal and the purchase of a certain percentage of Spanish coal. The Decree authorises the formation of syndicates of coal merchants and importers in the different ports, and such a syndicate has been established at Barcelona. In this case the Trust will be compelled to purchase annually from the Spanish coalowners a quantity of coal equivalent to 48 per cent. of the total consumption of the Barcelona area, excluding the railways. It is understood that similar Trusts are being formed at Seville and Bilbao, and the percentage of Spanish coals which must be taken annually in those areas is stated as likely to be 60 and 44 per cent. respectively. There is just the possibility that the new agreement entered into between the parties, viz., the merchants and the Spanish coalowners, together with the Royal Decree, may eventually prove more harmful to the exporting interests in the United Kingdom than is now anticipated, as the provision is made that the Ministro de Fomento may at any time direct that the merchants at any port in Spain shall form themselves into a Trust similar to that set up in Barcelona, and, in addition, merchants controlling two-thirds of the coal imported at any port will be able to form themselves into a Trust and thus compel the other merchants in that particular area to fall into line with their wishes. Another factor which must not be overlooked is the provision which may at any time have the effect of curtailing the import of foreign coals into Spain. Article 8 of the Decree stipulates that the quantity of national coal to be taken shall be based on the average import of national coal in the previous year, subject, however, to a coefficient which will depend upon the obligations imposed on particular industries by existing laws. Thus it will be seen that the "coefficient" can be fixed at a figure which may have the effect of reducing the quantity of foreign coals that can be imported.

Coalfield Items.

An indication of the state of trade is forthcoming in the fact that further notices have been given by collieries to their workmen. Workmen and officials to the number of about 3000 at the collieries belonging to Nixon's Navigation Company at Mountain Ash are reported to have received notices. In the case of the collieries at Maesteg belonging to North's Navigation Company the whole of the men have had fourteen days' notice to terminate their employment. A fortnight ago the officials at the collieries received notices, so that they all will now terminate at the same time. In the Monmouthshire area miners numbering about 2000 have had similar notices. If they all take effect the position will be serious for the areas concerned.

Tin-plate Industry.

The position so far as the tin-plate trade is concerned is that orders are not quite so numerous and prices are just a shade easier. The decision has been come to by Welsh plate and sheet manufacturers that the period of restriction of output shall be two weeks next quarter. Up to now the period has been three weeks per quarter. Hopes are entertained that after the August holiday it will be unnecessary to have further restriction in the industry.

Current Business.

Dullness has characterised the steam coal market all round, and there is not even the variation of prices to create interest. The fact is that all qualities are down to the minimum figures arranged for the different classes, and to these prices colliery salesmen are holding whether they get business or not. The day-to-day inquiry is negligible, so that very little life prevails. In the case of patent fuel the foreign demand is even slower than for steam coals, and works find it difficult to continue operations.

Catalogues.

PETTERS, Ltd., Westland Works, Yeovil.—Details of "Universal" paraffin and petrol engines.

MAWDSLEY'S LTD., Dursley, Glos.—A leaflet describing a new form of multi-operator welding dynamo.

THE BIRMINGHAM SMALL ARMS COMPANY, Ltd., Birmingham. —A booklet dealing with B.S.A. drop forgings.

MERRYWEATHER AND SONS, Ltd., London, S.E. 10.—A leaflet illustrating fireproof blankets and their uses.

ALLEN LIVERSIDGE, Ltd., Victoria Station House, S.W. 1.—A leaflet dealing with A.-L. ferro arc electrodes.

ROBERT BOBY, Ltd., St. Andrew's Works, Bury St Edmunds. —Catalogue M.H. 2 of materials handling plant.

J. BEARDSHAW AND SON, Ltd., Sheffield.—Instructions for the treatment of high-speed tools and alloy steels.

ENGINEERING SUPPLIES, Ltd., 11, Queen Victoria-street, E.C. 4.—Particulars of "New Era" tachometers.

HENRY PELS, 32, Osnaburgh-street, N.W. 1.—List of hand power punches, croppers, and plate and joist shears.

JOSEPH KAYE AND SONS, Ltd., Lock Works, Leeds.—Catalogue of oil feeders, petrol funnels, oil cabinets, &c.

SOCIETE RATEAU, 28, Russell-square, W.C. 1.—Brochure No. 99, illustrating marine auxiliaries of all classes.

WALWORTH, Ltd., 90–96, Union-street, S.E. 1.—A loose-leaf folder containing Walworth Bulletins Nos. 1 to 12.

HOLINTER, Ltd., Dashwood House, Old Broad-street, E.C. 2.— Pamphlet describing the "Polyp" grab and its capabilities.

VERSCHURE AND COMPANY, Amsterdam.—A brochure illustrating and describing the firm s shipyards and their products.

BROOKHURST SWITCHGEAR, Ltd., Northgate Works, Chester. —A booklet entitled "Electric Control of Textile Machinery."

HEAD, WRIGHTSON AND CO., Ltd., Thornaby-on-Tees.— Particulars of the "Colorado" convertible discharge ball mill.

FRY'S (LONDON), Ltd., 24, Water-lane, E.C. 4.—A leaflet giving the advantages of the "Stick-to" patented drill chuck.

THOMAS RYDER AND SON, Ltd., Bolton.—Catalogue 128 on the "Ryder" "verticalauto" machine tool for production work.

G. AND J. WEIR, Ltd., Catheart, Glasgow.—"A New Step in Engine-room Economy," and "The Weir Optimum Deaerator."

DAVID BRIDGE AND CO., Ltd., Castleton, Manchester.—Catalogue Section H2 on the "Brinden" assembler haulage tractor.

J. BARDELL SMITH AND CO., Leicester.—Booklet No. 106, dealing with pulley blocks fitted with special steel electric welded chains.

J. F. RATCLIFF, Ltd., New Summer-street, Birmingham.— Brochure describing the production of rolled metals in the firm's works.

LACY, HULBERT AND CO., Ltd., 91, Victoria-street, S.W. 1.— List C.1 of the "Boreas" automatic electric driven air compressor.

F. C. HIBBERD AND CO., Ltd., 16, Northumberland Avenue, W.C. 2.—A loose leaf folder on "Planet" petrol or paraffin locomotives.

WALTER MCGEE AND SON, Ltd., Albion Works, Paisley.— Leaflet No. 1110 describing the firm's latest forced air-cooled totally enclosed motors.

BOLCKOW, VAUGHAN AND CO., Ltd., Middlesbrough.—Bulletin No. 1, giving particulars of the manufacture of silica and fireclay refractory products.

GREENWOOD AND BATLEY, Ltd., Albion Works, Leeds.— Specifications of the various types and sizes of "Greenbat" electrical industrial trucks.

ENGLISH ELECTRIC COMPANY, Ltd., Queen's House, Kingsway, W.C. 2.—Publication No. 917, dealing with dual frequency motors for 25 and 50 cycles.

THE HARLAND ENGINEERING COMPANY, Ltd., Alloa, Scotland. —A publication illustrating the company's range of electrical and hydraulic machinery.

THE BRITISH THOMSON-HOUSTON COMPANY, Ltd., Rugby.— The following pamphlets :—"Truck Type Switchgear," "Ironclad Draw-out Switchgear," "Ironclad Oil-immersed Circuit-Breakers," "Ironclad Switch Fuses," "Instrument Transformers," "Oil-immersed Voltage Transformers," "Air-cooled Current Transformers," "Alternating-current Brake Magnets" "D.C. Controllers for Tramcars."

UNIVERSITY COLLEGE, LONDON : ENGINEERING AWARDS.— The following awards have been made at University College in the Faculty of Engineering :—Goldsmid Entrance Scholarship, R. Russell, King Edward VI. Grammar School, Bath ; Jews' Commemoration Scholarship, for the student of one year's standing not being medical, who is most distinguished by general proficiency and good conduct, F. E. Bland. L. F. Vernon-Harcourt Prize (Civil and Municipal Engineering), F. L. Lambert. Chadwick Medal and Prize (Municipal Engineering and Municipal Hygiene), A. F. Fadelle. Archibald P. Head Medal and Prize, for the most distinguished engineering student, D. Bastow. Twelve diplomas, four with distinction, have been awarded in civil and municipal engineering, two in mechanical engineering, and three in electrical engineering.

Current Prices for Metals and Fuels.

IRON ORE.

N.W. COAST—	
(1) Native	19/- to 21/-
(1) Spanish	19/- to 21/-
(1) N. African	19/- to 21/-
N.E. COAST—	
Native	18/- to 21/-
Foreign (c.i.f.)	22/6

PIG IRON.

	Home. £ s. d.	Export. £ s. d.
(2) SCOTLAND—		
Hematite	3 14 0	—
No. 1 Foundry	3 15 0 to 3 16 0	—
No. 3 Foundry	3 11 0	—
N.E. COAST—		
Hematite Mixed Nos.	3 9 0	3 9 0
No. 1	3 9 6	3 9 6
Cleveland—		
No. 1	3 8 6	3 8 6
Silicious Iron	3 8 6	3 8 6
No. 3 G.M.B.	3 6 0	3 6 0
No. 4 Foundry	3 5 0	3 5 0
No. 4 Forge	3 4 6	3 4 6
Mottled	3 4 0	3 4 0
White	3 4 0	3 4 0
MIDLANDS—		
(3) Staffs.—		
All-mine (Cold Blast)	—	—
North Staffs. Forge	—	—
,, ,, Foundry	3 2 6	—
(3) Northampton—		
Foundry No. 3	2 15 0 to 2 17 0	—
Forge	2 13 6	—
(3) Derbyshire—		
No. 3 Foundry	2 19 0 to 3 1 0	—
Forge	2 18 0	—
(3) Lincolnshire—		
No. 3 Foundry	3 1 0	—
No. 4 Forge	2 18 6	—
Basic	3 0 0	—
(4) N.W. COAST—		
N. Lancs. and Cum.—		
Hematite Mixed Nos.	4 1 0 (a) / 4 4 0 (b) / 4 7 6 (c)	—

MANUFACTURED IRON.

	Home. £ s. d.	Export. £ s. d.
SCOTLAND—		
Crown Bars	10 5 0	9 15 0
Best	—	—
N.E. COAST—		
Iron Rivets	11 5 0	—
Common Bars	10 5 0	—
Best Bars	10 15 0	—
LANCS.—		
Crown Bars	10 0 0	—
Second Quality Bars	9 10 0	—
Hoops	13 0 0	—
S. YORKS.—		
Crown Bars	10 10 0	—
Best Bars	11 0 0	—
Hoops	11 10 0 to 12 0 0	—
MIDLANDS—		
Crown Bars	9 5 0 to 10 0 0	—
Marked Bars (Staffs.)	12 0 0	—
Nut and Bolt Bars	8 17 6 to 9 0 0	—
Gas Tube Strip	10 15 0 to 10 17 6	—

STEEL. (d)

	(6) Home. £ s. d.	(7) Export. £ s. d.
(5) SCOTLAND—		
Boiler Plates	10 10 0	10 10 0
Ship Plates, ½in. and up	8 7 6	7 12 6
Sections	7 17 6	7 2 6
Steel Sheets, ¼in.	8 12 6	8 10 0
Sheets (Gal.Cor. 24 B.G.)	13 7 6 to 13 12 6	13 7 6

STEEL (*continued*).

	Home. £ s. d.	Export. £ s. d.
N.E. COAST—		
Ship Plates	8 7 6	—
Angles	7 17 6	—
Boiler Plates	12 15 0	—
Joists	7 17 6	—
Heavy Rails	8 10 0	—
Fish-plates	12 0 0	—
Channels	10 5 0	£9 to £9 5
Hard Billets	7 12 6	—
Soft Billets	6 15 0	—
N.W. COAST—		
BARROW—		
Heavy Rails	8 5 0	—
Light Rails	8 10 0 to 8 15 0	—
Billets	7 10 0 to 10 0 0	—
MANCHESTER—		
Bars (Round)	8 17 6	—
,, (Small Round)	7 15 0	—
Hoops (Baling)	10 0 0	9 15 0
,, (Soft Steel)	9 0 0	8 15 0
Plates	8 12 6	—
,, (Lancs. Boiler)	9 10 0 to 9 15 0	—
SHEFFIELD—		
Siemens Acid Billets	10 0 0	—
Hard Basic	7 2 6 to 7 12 6	—
Intermediate Basic	7 0 0	—
Soft Basic	6 5 0 to 6 7 6	—
Hoops	9 0 0	—
Soft Wire Rods	7 5 0 to 7 10 0	—
MIDLANDS—		
Small Rolled Bars	7 17 6 to 8 0 0	—
Billets and Sheet Bars	6 0 0 to 6 1 6	—
Sheets (20 W.G.)	11 10 0 to 12 0 0	—
Galv. Sheets, f.o.b. L'pool	13 7 6 to 13 10 0	—
Angles	7 17 6	—
Joists	7 17 6	—
Tees	8 17 6	—
Bridge and Tank Plates	8 12 6	—
Boiler Plates	11 0 0	—

NON-FERROUS METALS.

SWANSEA—	
Tin-plates, I.C., 20 by 14	18/3 to 18/4½
Block Tin (cash)	213 0 0
,, (three months)	209 10 0
Copper (cash)	62 16 3
,, (three months)	62 2 6
Spanish Lead (cash)	20 10 0
,, (three months)	20 17 6
Spelter (cash)	24 11 3
,, (three months)	24 17 6
MANCHESTER—	
Copper, Best Selected Ingots	67 0 0
,, Electrolytic	69 10 0
,, Strong Sheets	94 0 0
,, Tubes (Basis Price), lb.	0 1 1½
Brass Tubes (Basis Price), lb.	0 1 0
,, Condenser, lb.	0 1 2
Lead, English	22 5 0
,, Foreign	21 2 6
Spelter	25 0 0
Aluminium (per ton)	£107

FERRO ALLOYS.

	Per Ton.	Per Unit.
Tungsten Metal Powder	1/7½ per lb.	
Ferro Tungsten	1/3 per lb.	
Ferro Chrome, 4 p.c. to 6 p.c. carbon	£22 0 0	7/6
,, ,, 6 p.c. to 8 p.c. ,,	£21 15 0	7/-
,, ,, 8 p.c. to 10 p.c. ,,	£21 0 0	6/-
,, ,, Specially refined		
,, ,, Max. 2 p.c. carbon	£33 15 0	12/-
,, ,, ,, 1 p.c. carbon	£39 0 0	15/-
,, ,, ,, 0·70 p.c. carbon	£45 0 0	17/-
,, ,, ,, carbon free	1/2 per lb.	
Metallic Chromium	2/8 per lb.	
Ferro Manganese (per ton)	£13 10 0 for home	
	£13 10 0 for export	
,, Silicon, 45 p.c. to 50 p.c.	£12 15 0 scale 5/- per unit	
,, ,, 75 p.c.	£20 0 0 scale 6/- per unit	
,, Vanadium	14/3 per lb.	
,, Molybdenum	4/6 per lb.	
,, Titanium (carbon free)	1/2 per lb.	
Nickel (per ton)	£170 to £175	
Ferro-Cobalt	9/- per lb.	

FUELS

SCOTLAND.

(*Prices not stable.*)

	Export.
LANARKSHIRE—	
(f.o.b. Glasgow)—Steam	13/9
,, ,, Ell	14/3 to 14/6
,, ,, Splint	16/- to 17/-
,, ,, Trebles	13/-
,, ,, Doubles	12/6 to 12/9
,, ,, Singles	12/-
AYRSHIRE—	
(f.o.b. Ports)—Steam	13/6
,, ,, Jewel	15/6
,, ,, Trebles	13/-
FIFESHIRE—	
(f.o.b. Methil or Burntisland)—Steam	10/9 to 12/9
Screened Navigation	18/-
Trebles	12/9 to 13/-
Doubles	12/6 to 12/9
Singles	11/6
LOTHIANS—	
(f.o.b. Leith)—Best Steam	12/-
Secondary Steam	11/6
Trebles	12/6 to 13/-
Doubles	12/6
Singles	11/6 to 12/-

ENGLAND.

(8) N.W. COAST—	
Steams	24/- to 25/-
Household	37/6 to 50/-
Coke	22/6 to 23/6
NORTHUMBERLAND—	
Best Steams	13/3 to 13/6
Second Steams	11/9 to 12/-
Steam Smalls	9/- to 9/6
Unscreened	11/9 to 12/-
Household	21/- to 27/-
DURHAM—	
Best Gas	15/-
Second	13/3 to 13/9
Household	21/- to 27/-
Foundry Coke	18/3 to 19/-
SHEFFIELD—	Inland.
Best Hand-picked Branch	26/- to 27/6 —
Derbyshire Best Bright House	19/6 to 20/6 —
Best House Coal	18/6 to 20/- —
Screened House Coal	16/- to 17/- —
,, ,, Nuts	14/- to 15/6 —
Yorkshire Hards	14/- to 16/- —
Derbyshire Hards	14/- to 16/- —
Rough Slacks	8/6 to 9/6 —
Nutty Slacks	5/- to 6/- —
Smalls	3/- to 4/6 —
Blast-furnace Coke (Inland)	13/- at ovens —
Furnace and Foundry Coke (Export), f.o.b.	18/6 to 19/6

(9) SOUTH WALES.

CARDIFF—	
Steam Coals:	
Best Smokeless Large	19/3 to 19 6
Second Smokeless Large	18/- to 19/-
Best Dry Large	18/- to 18/6
Ordinary Dry Large	17/3 to 17/9
Best Black Vein Large	17/6 to 17/9
Western Valley Large	17/- to 17/3
Best Eastern Valley Large	16/6 to 17/3
Ordinary Eastern Valley Large	16/3 to 16/6
Best Steam Smalls	12/6 to 13/-
Ordinary Smalls	10/6 to 12/-
Washed Nuts	16/6 to 18/6
No. 3 Rhondda Large	19/6 to 20/-
,, ,, Smalls	14/- to 14/6
No. 2 ,, Large	16/- to 16/6
,, ,, Through	14/6 to 15/6
,, ,, Smalls	12/- to 13/-
Foundry Coke (export)	30/- to 37/6
Furnace Coke (export)	27/6 to 30/-
Patent Fuel	21/- to 22/-
Pitwood (ex ship)	27/6 to 27/9
SWANSEA—	
Anthracite Coals:	
Best Big Vein Large	33/- to 35/6
Seconds	24/6 to 27/6
Red Vein	20/6 to 27/-
Machine-made Cobbles	40/- to 43/-
Nuts	35/- to 43/-
Beans	23/6 to 26/-
Peas	18/- to 19/-
Breaker Duff	8/- to 8/3
Rubbly Culm	12/- to 12/6
Steam Coals:	
Large	17/6 to 18/6
Seconds	16/- to 17/-
Smalls	10/- to 12/6
Cargo Through	15/- to 16/-

(1) Delivered. (2) Net Makers' Works. (3) f.o.t. Makers' Works, approximate. (4) Delivered Sheffield. (5) Glasgow, Lanarkshire and Ayrshire.

(6) Home Prices—All delivered Glasgow Station. Boiler Plates 10/- extra delivered England. (7) Export Prices—f.o.b. Glasgow. (8) Except where otherwise indicated, coals are per ton at pit for inland and f.o.b. for export, and coke is per ton on rail at ovens and f.o.b. for export. (9) Per ton f.o.b. (a) Delivered Glasgow. (b) Delivered Sheffield. (c) Delivered Birmingham. (d) Rebate 12/6 joists and 10/- all other materials if home consumers confine purchases solely to British products.

French Engineering Notes.

(*From our own Correspondent in Paris.*)

Peat Congress.

A good deal of prominence has been given to the Peat Congress recently held at Laon, which centre was chosen on account of its proximity to the peat deposits of Notre-Dame-de-Liesse, where a plant has been installed to demonstrate the commercial possibilities of the fuel. The Congress coincided with a run of commercial vehicles from Paris to Strasburg with home-produced fuels, including suction gas plants employing peat, and there was naturally plenty of optimism regarding the economies that can be effected by the use of all kinds of fuels produced in the country. There is, of course, no reason why the poorest fuels should not be employed for power purposes, except the cost, and it has yet to be proved that dry peat can be produced cheaply enough to compete with other fuels. During the Congress it was declared that it could be done, and that it was quite possible that peat could be used for the electrification of districts where peat deposits existed. The real value, of peat, however, lies in the extraction of oils, if it can be done economically.

A Big Electro-magnet.

Long before the war, the Académie des Sciences endeavoured to procure the means necessary to construct a powerful electro-magnet which would permit of valuable research work being carried out. It was only, however, when the national subscription in aid of the laboratories, at the time of the Pasteur commemoration, provided the funds that the Academy was able to construct the machine which has been installed at the Office National des Recherches Scientifiques et des Inventions at Bellevue, near Paris. The machine was built by the Cie Française Thomson-Houston to the original designs of Messrs Weiss and Pickard, modified by Messrs. Cotton and Mabboux. The frame is built up of steel castings in the form of bars 400 mm. square, and each side of the frame is nearly 3 m. square. On the two lower bars slide vertical standards carrying the core and the coils. The coils are wound with electrolytic copper tubes of square section through which water circulates for cooling. The section is 15·5 mm. square, and the bore has a diameter of 8·9 mm. The length of tubing used is 5500 m., and its weight is 8·6 tons. The terminal faces of the pole pieces have diameters ranging from 3 mm. to 750 mm. All those with diameters of less than 250 mm. are of ferro-cobalt, which was prepared with the collaboration of M. Charpy. The total weight of the machine is 115 tons. It has not yet been possible to obtain exact measures of the electro-magnetic field, but what has been done appears to verify the results secured with the model which served for its construction, and it is proposed to increase considerably the power of the machine with the use of supplementary coils. The machine is installed in a special laboratory equipped with centrifugal pumps, and it is placed above a pit, 9 m. deep, where the temperature is kept constant. Arrangements will be made for carrying out, with the aid of this apparatus, most delicate optical researches into the effects of the electro-magnetic field.

The Pyrenees Railway.

This week there was put into service the new line through the Pyrenees, which has been completed after more than fifty years of effort to settle upon some project that would prove satisfactory alike to France and Spain. Before the war the Cie du Midi had extended the line from Pau to Oloron as far as Bedous, and since then the work of joining up the French and Spanish railway systems has been actively pushed forward. The character of the line from Bedous has already been summarised in this column. The line rises steadily over a series of bridges, viaducts and tunnels until it traverses the highest part of the mountain range through the helical tunnel of Somport, which is 7875 m. long. On the southern side the Spanish railway company has built a magnificent international station at Canfranc. From that point the line falls easily down the Valley d'Aste to Jaca, the former terminus of the Spanish system. On account of the difference of gauge passengers and goods will have to be transferred at Canfranc. The French line is, of course, electrified, but steam locomotives will continue to be used in Spain, at least for some time to come. The opening ceremony on July 18th was carried out at the international station at Canfranc in the presence of the President of the French Republic and the King of Spain. Two other lines are in course of construction through the Pyrenees. The one, which will connect up Toulouse with Barcelona by a line from Ax-les-Thermes under the Col de Puymorens to Ripoll in Spain, is expected be to completed next year. The third line is from Saint-Girons in France to Esterri de Aneo in Spain under the Port de Salau.

Port of Strasburg.

When Strasburg was returned to France, arrangements were made to insure that the interests of the port should not be jeopardised by the rivalry of Kehl, on the opposite bank of the Rhine, which Germany had for years previously been developing. Under the Versailles Treaty, therefore, the exploitation of both Strasburg and Kehl was placed under the control of the Commission Centrale du Rhin which permitted of the traffic being gradually diverted to Strasburg during the time that the port was being extended. The work has been pushed forward so rapidly that it has been practically completed before the limit fixed for the Commission Centrale du Rhin to relinquish its control and thereby allow Germany to do what she likes with the port of Kehl. The proportion of French traffic passing through Kehl has fallen from 16 to 2 per cent. The traffic of Strasburg increased from 1,100,000 tons in 1913 to 4,350,000 tons in 1927. The position of Strasburg is now so strong that it no longer fears the competition of Kehl, and it is looking forward to the time when, with the construction of the Alsace Canal and the canalisation of the Rhone, it will become by far the greatest inland port in Europe. This is one reason why the Germans are opposing so strongly the Alsace Canal.

British Patent Specifications.

When an invention is communicated from abroad the name and address of the communicator are printed in italics.

When an abridgment is not illustrated the Specification is without drawings.

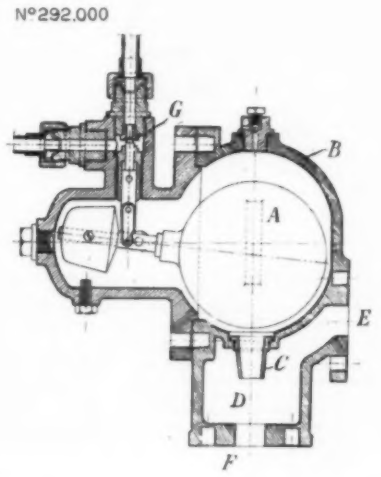
Copies of Specifications may be obtained at the Patent Office Sale Branch, 25, Southampton-buildings, Chancery-lane, W.C., at 1s. each.

The date first given is the date of application ; the second date, at the end of the abridgment, is the date of the acceptance of the complete Specification.

CONDENSERS AND FEED-WATER HEATERS.

292,000. September 20th, 1927.—Feed Regulators, E. Torre, Via Serra 7, Genoa, Italy.

In this regulator the float A is enclosed in a chamber B, which is in communication with the boiler only through the nozzle C. This nozzle opens into the space D, which communicates with the steam and water spaces of the boiler by the branches E and F. In the event of the water level in the boiler falling below

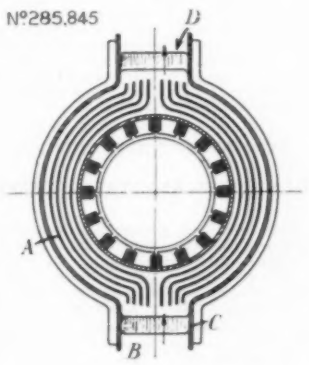


the bottom of the nozzle C, the chamber B quickly fills with steam and the float falls. With a rise of the water level the nozzle is immersed, the steam in the chamber B soon condenses and the chamber is filled with water, so that the float rises. The movements of the float are used to operate the needle valve G, which controls the opening and closing of the feed check valve on the boiler.—*June 14th*, 1928.

DYNAMOS AND MOTORS.

285,845. August 22nd, 1927.—Improvements in or relating to Cooling Arrangements for Dynamo-electrical Machines, Otto Titusz Bláthy, of 39, Lóvóház utca, Budapest II., Hungary.

The stator of the machine described in this specification is water cooled. Hollow cooling elements A are interposed between

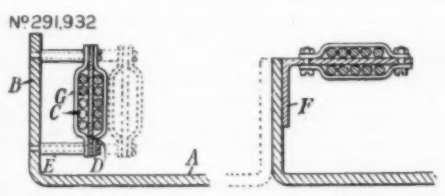


the separate groups of laminations. Cooling water enters at B and is conveyed through the distributing passage C to the individual cooling elements, and it leaves by way of the outlet D. The cooling elements are composed of two pressed sheet laminations, which are welded together.—*June 14th*, 1928.

SWITCHGEAR.

291,932. April 28th, 1927.—Improvements relating to Electric Switchboards and the like, The British Thomson-Houston Company, Ltd., of Crown House, Aldwych, London, W.C. 2, and Herbert Christopher Heath, of 51, Kingsway, Wembley, Middlesex.

According to this invention, the switch panels A have integral



edges B at right angles to the main plane of the panel. The electric wires C may be arranged on either or both sides of the strip or plate D, which may be arranged parallel to the extending edges B or at right angles to it as in the right-hand view. The strips D may be secured by means of bolts with spacing pieces E or by brackets F, which may be screwed to the edges B. The wires are conveniently clamped by means of the small cleats G held together against the plates D by the bolts. If the wires are numerous a second plate, as indicated by dotted lines, may be provided.—*June 14th*, 1928.

TRANSFORMERS AND CONVERTERS.

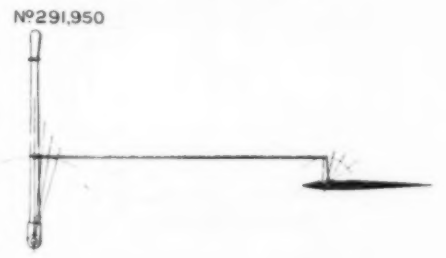
292,265. March 21st, 1927.—Improvements in or relating to Transformers, *Stanley Gordon Sinclair Dicker, of* 20 *to* 23, *Holborn, London, E.C.* 1.

This invention relates to transformers and more particularly to small transformers, such as those used in wireless telephony and telegraphy. As a rule the windings of such transformers are composed of wires of copper. A disadvantage of copper is that its tensile strength is not great and its resistance to corrosion is insufficient. According to this invention at least one of the windings is composed of wire which consists of an alloy of copper and silver. The tensile strength of such an alloy is greater than that of copper, so that it is possible to draw the alloy down into wires having a smaller diameter than is possible in the case of copper. In addition, the resistance to corrosion of the alloy is materially more satisfactory than that of copper. Satisfactory results are obtained by the use of an alloy containing at least 94 per cent. of silver. As a result of the high content of silver there is no free copper left in the alloy, so that practically no oxidation occurs. In addition, the tensile strength is materially increased. As the alloy, moreover, has only a very low ohmic resistance it serves admirably as material for the wire of the primaries of low-frequency transformers used in wireless telephony and telegraphy. The alloy may have added to it small quantities of nickel, with the result that the liability of oxidation is further decreased.—*June 21st*, 1928.

AERONAUTICS.

291,950. June 2nd, 1927.—Control Mechanism, H. J. L. Hinkler, Mon Repos, Thornhill Park, Southampton.

This invention really resolves itself into the application of a well-known mechanical linkage to a special purpose. It is suggested that when a machine is flying at a high speed considerable

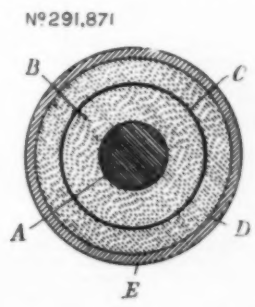


force is required to manipulate the control surfaces, and that fine adjustment is required. On the other hand, at lower speeds less effort and a coarser adjustment are advisable. The linkage comprises two levers of unequal length and a connecting-rod, as shown in the drawing, the operation of which is obvious.—*June 14th*, 1928.

TRANSMISSION OF POWER.

291,871. March 9th, 1927.—Improvements in Single-core Electric Cables, Standard Telephones and Cables, Ltd., and Thomas Nixon Riley and Thomas Robertson Scott, all of Connaught House, Aldwych, London, W.C. 2.

This invention relates to improvements in single-core electric cables intended for transmitting power in which the conductor is surrounded by a fibrous dielectric, preferably paper, impregnated with a suitable oil or liquid compound, the whole being enclosed in a metal sheath. It is well known that in cables of this type, the nearer the structure resembles a perfect condenser, the more efficient does the cable become. The object of the invention is to improve a cable in this respect. In the diagram A is the main core and B the main insulation, preferably in the form of paper. Around this insulation there is a permeable intersheath C in the form of metallised paper. A porous layer



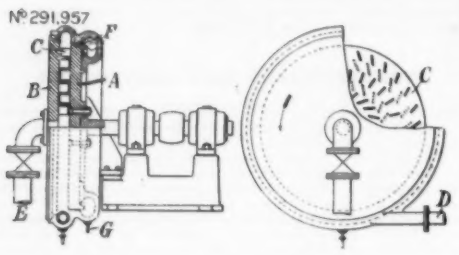
D of paper, having less absorbent properties than the insulation B, is also applied, and the whole of the composite structure is enclosed in the usual lead sheath E. The fibrous layer B is impregnated with oil or liquid compound, usually employed in this type of cable. The layer D may also be impregnated. When the cable is in use, owing to temperature conditions, &c., the dielectric expands and some of the impregnating material may pass through the permeable intersheath and be taken up by the semi-porous layer D, or the space found outside this layer by expansion of the sheath. In this manner the dielectric between the intersheath C and the core A is maintained substantially homogeneous. In the event of contraction taking place, impregnating material will be drawn back by the more absorbent layer B, so that the homogeneity of the dielectric is maintained. —*June 11th*, 1928.

CRUSHING AND GRINDING.

291,957. June 13th, 1927.—Centrifugal Grinding Machinery, C. P. Walker, 12, Cowper-road, Hanwell, W. 7.

Apparently this machine is intended for grinding paint and similar materials, and its chief peculiarity lies in the fact that it is fed from the periphery inwards, so that the material to be ground has to be driven forward against the centrifugal force. In this way, it is claimed, a most intensive disintegrating effect

can be obtained. The machine comprises a rotating disc A and a fixed disc B, both of which are provided with intercalating pegs C. The material to be ground is forced into the machine

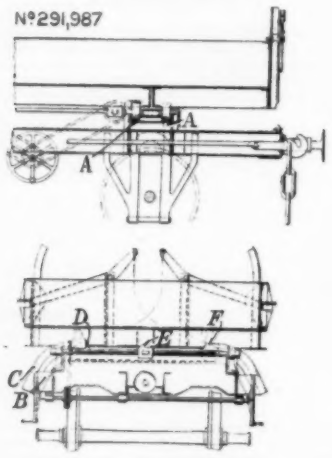


at D, and is discharged at E. Any material which leaks past the running joint F is drained away at G.—*June 14th*, 1928.

TRAMWAYS AND RAILWAYS.

291,987. August 15th, 1927.—SIDE-TIPPING WAGONS, A. S. Bailey and the Leeds Forge Company, Ltd., Leeds.

With this wagon the tipping effect is produced by moving the body sideways with regard to the underframe and wheels. On the underframe there are fixed transverse rails A A in the form of angle irons. These rails are curved downwardly at the outside ends, as shown at B and thereabouts there are superimposed other guide rails C, of reversed angles. The body is

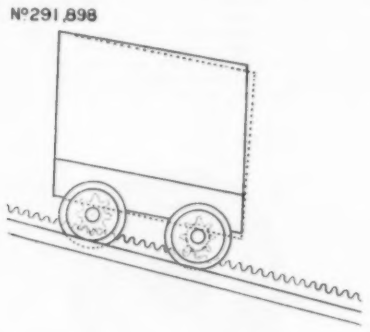


carried by triple rollers D E F. When the body is moved sideways, by means of the screw gear provided, one of the outside rollers, D or F, is caught by the guide rails and is forced downward, while the body tips over on the centre roller E.—*June 14th*, 1928.

MINING MACHINERY.

291,898. March 17th, 1927.—RUN-AWAY CHECKS FOR PIT TUBS, A. Bannister, 14, Rawdon-road, Wallsend-on-Tyne, and J. Duffy, 14, Union-street, Wallsend-on-Tyne.

In order to prevent pit tubs from running away down inclines



the inventors propose to fit their axles with excentric toothed wheels, which engage with racks placed between the running metals on the inclines. It is suggested that the excentricity will cause the tub and its load to rise and fall, and that this will prevent running away.—*June 14th*, 1928.

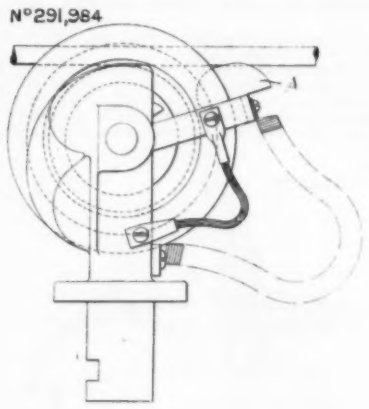
MISCELLANEOUS.

291,988. August 15th, 1928.—WATERPROOF PLASTIC PORTLAND CEMENT, E. C. R. Marks, 57 and 58, Lincoln's Inn-fields, London, W.C. 2.

This invention relates to the manufacture of Portland cement or hydraulic cement and the main object of the invention is to provide for making Portland cement more waterproof and also for increasing the plasticity of the mortar, plaster or concrete made from the cement. The inventors state that they have found that an effective waterproofing and plasticising agent may be produced from shale, clay or other naturally occurring earth containing hydrocarbon oil or bituminous matter in oil soluble form such as is found in the vicinity of the Santa Maria Field, Santa Barbara County, California, such shale containing about 20 to 35 per cent. of hydrocarbon oil soluble in the usual solvents for hydrocarbon oil and capable of extraction by use of such solvents, and the composition of the inorganic or ash constituents —residue after ignition—being, for example, as follows:—SiO_2, 71·7; Fe_2O_3, 5·4, Al_2O_3, 13·7; CaO, 4·3; Undetermined, 4·9. The silica in this residue may be considered as partly in combination with the alumina and oxide of iron in the form of silicates of aluminium and iron—clay, feldspar, &c.—but more or less free finely divided silica will, of course, be generally present. As an example of one method of manufacture of the improved waterproof cement a naturally occurring oil-bearing argillaceous shale or clay such as above referred to may be reduced by crushing or grinding to a suitable state of division, for example, ¼in. mesh or finer, and then added to cement clinker and ground therewith to produce a cement of the usual fineness for Portland cement. Or the oil-bearing argillaceous shale or clay may be ground in the first place to suitable fineness, say, 200 mesh or finer, and then mixed with the ground Portland cement in any suitable mixing apparatus.—*June 14th*, 1928.

291,984. July 28th, 1927.—IMPROVEMENTS IN TROLLEY HEADS AS USED ON ELECTRIC TRAMWAY AND RAILWAY VEHICLES, Arthur Chantrey Baker, 69, Alcester-road, Moseley, Birmingham, and Hector McPhail Dudgeon, 169, Aston-lane, Perry Bar, Birmingham.

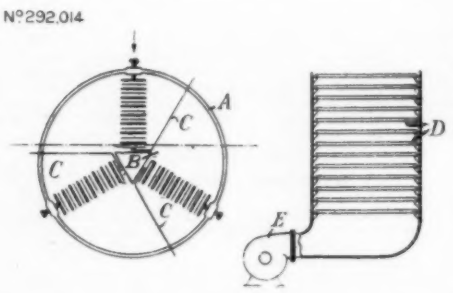
The wear that occurs on the trolley wires and on the trolley



wheels of electric traction systems is caused mainly by arcing. The object of this invention is to minimise this wear. In addition to the usual wheel a light contact A is provided and is held in contact with the wire by means of a spring.—*June 14th*, 1928.

292,014. November 14th, 1927.—IMPROVEMENTS IN OR RELATING TO RECTIFIERS FOR ELECTRIC CURRENTS, Siemens-Schuckertwerke Aktiengesellschaft, of Berlin-Siemensstadt, Germany; and Gunther Scharowsky, of 67, Strasse G 7, Kolonie Eichkamp, Grunewald, Germany.

According to this invention metal rectifiers are grouped as shown. A is a metal ring with set screws which force the groups



of rectifiers into contact with the block of insulating material B. The rectifiers that are next to the body B can be connected by wires C to a source of three-phase current, whilst the rectifiers at the other ends of the groups are connected in parallel by the set screws. The specification also describes an arrangement for cooling groups of metal rectifiers constructed in this manner. The sets of rectifiers D are mounted in a tubular casing which is connected to a fan E.—*June 14th*, 1928.

LAUNCHES AND TRIAL TRIPS.

CASPIA, single-screw tank steamer; built by Sir W. G. Armstrong, Whitworth and Co., Ltd., to the order of the Baltic Trading Company; dimensions, length, 427ft.; breadth, 53ft.; depth, 31ft. 6in.; 8475 tons. Engines, direct-acting, surface condensing, triple-expansion, 27in., 45in. and 75in. diameter by 48in. stroke, pressure 120 lb. per square inch; launch, July 4th.

GRACEFIELD, single-screw steamer; built by Swan, Hunter and Wigham Richardson, Ltd., to the order of E. J. Sutton and Co.; dimensions, length over 400ft.; breadth, 53ft. 6in.; depth, 24ft. 8000 tons deadweight. Engines, triple-expansion; launch, July 4th.

NYANZA, steamer; built by David and William Henderson and Co., Ltd., to the order of Maclay and McIntyre; dimensions, length, 403ft.; breadth, 52ft.; depth, 29ft. 10in.; 5000 tons gross. Engines, triple-expansion, 25in., 41in. and 67in. diameter by 51in. stroke, pressure 175 lb. per square inch; trial trip, July 4th.

BURDWAN, single-screw steamer; built by Barclay, Curle and Co., Ltd., to the order of Hain Steamship Company, Ltd.; dimensions, length, 435ft.; breadth, 57ft. 4in.; depth, 32ft. 3in.; 9200 tons deadweight. Engines, quadruple-expansion, 30½in., 44in., 63½in. and 91in. diameter by 57in. stroke, pressure 230 lb. per square inch; launch, July 5th.

COPTIC, twin-screw motor cargo ship; built by Swan, Hunter and Wigham Richardson, Ltd., to the order of Shaw, Savill and Albion Company, Ltd.; dimensions, length, 500ft. Engines, two six-cylinder Diesel; trial trip, July 5th.

CUIDAD DEL SALTO, twin-screw passenger and cargo motor vessel; built by Harland and Wolff, Ltd., to the order of the Argentine Navigation Company, Ltd.; dimensions, length, 250ft.; breadth, 42ft.; depth, 11ft. 6in.; 1620 tons gross. Engines, two six-cylinder, trunk piston engines; launch, July 5th.

KING WILLIAM, motor cargo vessel; built by Harland and Wolff, Ltd., to the order of the King Line, Ltd.; dimensions, length, 400ft.; breadth, 54ft. 6in.; depth, 34ft. 8in.; gross tonnage 5280. Engines, one six-cylinder, four-cycle, single-acting Diesel; trial trip, July 5th.

CLYDEFIELD, single-screw motor vessel; built by David and William Henderson and Co., Ltd.; to the order of Hunting and Son; dimensions, length 420ft., breadth 57ft. 9in., depth 32ft. 9in.; gross tonnage 6758, deadweight 9500 tons. Engines, eight-cylinder, four-stroke Diesel; constructed by Harland and Wolff, Ltd.; launch or trial trip, July 10th.

Forthcoming Engagements.

Secretaries of Institutions, Societies, &c., desirous of having notices of meetings inserted in this column, are requested to note that, in order to make sure of its insertion, the necessary information should reach this office on, or before, the morning of the Wednesday of the week preceding the meetings. In all cases the TIME *and* PLACE *at which the meeting is to be held should be clearly stated.*

TO-DAY.

INSTITUTE OF BRITISH FOUNDRYMEN: LANCASHIRE BRANCH, JUNIOR SECTION.—Visit to Globe Works of Tweedales and Smalley, Ltd., Castleton, near Rochdale. 3 p.m.

SATURDAY, JULY 21ST.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS.—South-Western District meeting at Ilfracombe. Assemble at the Victoria Pavilion at 12 noon.

KEIGHLEY ASSOCIATION OF ENGINEERS.—Visit to Messrs. George Mann and Co.'s works. Train leaves Keighley 1.28.

TUESDAY, JULY 31ST.

CRYSTAL PALACE SCHOOL OF PRACTICAL ENGINEERING.—167th award of certificates. 3 p.m.

PERSONAL AND BUSINESS ANNOUNCEMENTS.

THE B.E.N. PATENTS, Ltd., of 92, Tottenham Court-road, London, W. 1, asks us to announce that it has appointed Mr. J. E. M. Boyes as its representative in the Midlands, in place of Mr. E. A. Sanders, who has now no connection with the company.

MR. J. HAMILTON GIBSON asks us to announce that he has taken into partnership Mr. James Foster Petree, and will practise with him as from July 1st, 1928, under the style of Hamilton Gibson and Petree, consulting engineers, at 3, Central-buildings, Westminster, S.W. 1.

THE ASSOCIATED EQUIPMENT COMPANY, Ltd., of Southall, Middlesex, asks us to announce that Mr. George J. Rackham has been appointed chief engineer of that company as from August 1st, 1928, and will be responsible for the designing, experimental and research departments.

A. G. MUMFORD, Ltd., Colchester, informs us that it has appointed Mr. James A. Kinnaird, M.I.E.S. and A.M. Inst. E.E., of Glasgow and Greenock, as its managing director, in place of Engineer Lt.-Commander Alfred Burner, late R.N., who has resigned from that position, but will probably retain a connection with the company.

THE EQUIPMENT AND ENGINEERING COMPANY, Ltd., of 2 and 3, Norfolk-street, Strand, London, W.C. 2, asks us to announce that the business of the Equipment and Engineering Company, which since its inception in 1908 had traded as a private partnership, with Mr. E. E. Daglish and Mr. W. L. Lorkin as partners, was transferred on July 1st, 1928, to the Equipment and Engineering Company, Ltd., as a private limited liability company, with Mr. E. E. Daglish and Mr. W. L. Lorkin as joint managing directors. Mr. W. T. Robson and Mr. A. Vickers, who had been associated with the firm for many years, have been elected to the board of directors, together with Mr. P. V. Fearon, late of the Brush Electrical Engineering Company, Ltd.

CONTRACTS.

SIR W. G. ARMSTRONG, WHITWORTH AND CO., Ltd., have received an order for the construction of a large number of superheater locomotive boilers and other locomotive details for the Indian State Railways.

THE BRITISH THOMSON-HOUSTON COMPANY, Ltd., has obtained a twelve months' contract from the War Office for the supply of Mazda vacuum and gas-filled lamps to the Southern Command, stations abroad and the Chief Superintendent of Ordnance Factories.

SULZER BROS. have recently received an order for an eight-cylinder, two-cycle Diesel engine of 5000 brake horse-power, for the Bucharest Electricity Works; and an order for a 620 brake horse-power Sulzer engine for the electric power station in Jaipur, India. In both cases the engines will be direct coupled to alternators.

NEGRETTI AND ZAMBRA have received from the British Air Ministry an order for 1100 of their patented mercury-in-steel distance-reading thermometers for engine oil temperatures on aircraft. This is the seventh successive order for a total of over 4000 instruments which the Ministry has placed with the firm in the last few years.

SWAN, HUNTER AND WIGHAM RICHARDSON, Ltd., have received from Mr. Metcalfe, the managing director of the Rederiaktiebolaget Svenska Lloyd (Swedish Lloyd Steamship Company), of Gothenburg, an order for two fast passenger steamers for that line's service between Gothenburg and London. The vessels will be 377ft. long overall by 50ft. by 32ft. moulded depth; deadweight 2340 tons, and will be propelled by single-screw Parsons turbine machinery.

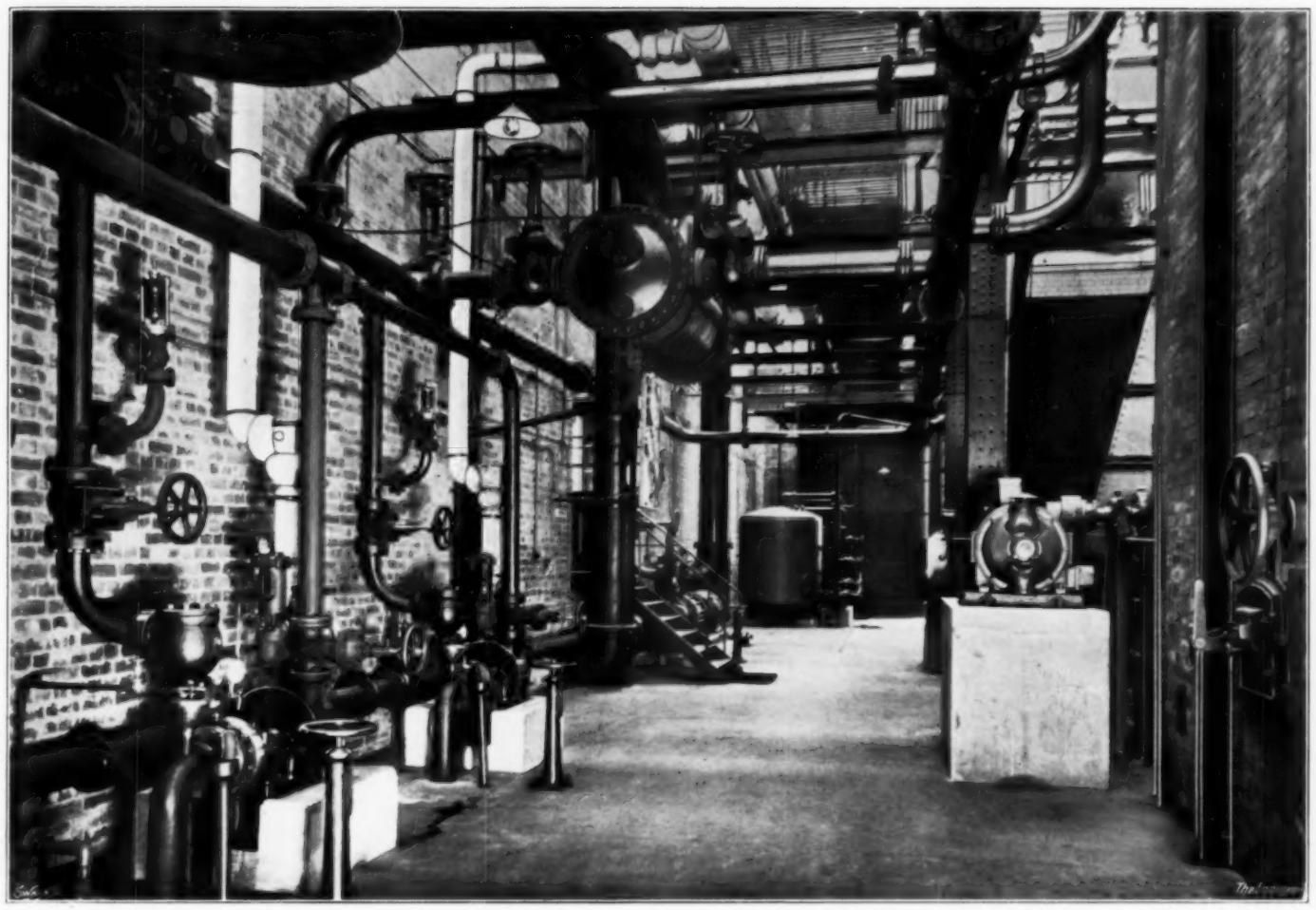
THE GENERAL ELECTRIC COMPANY, Ltd., has received the following orders:—(*a*) From the Palestine Electric Corporation for two vertical spindle 7500-kVA alternators, providing a three-phase supply at 6300/6900 volts, 50 cycles. These machines, which are to be driven by Boving water turbines at a speed of 250 r.p.m., are to be installed at the Jordan power-house, and will supply power to sub-stations situated at Jaffa and Haifa, the equipment for which is also to be supplied. (*b*) From the North-Western Railway, India, for two Diesel-electric locomotives of the 0–4–4–0 type, comprising a power unit on the main frame carried on two four-wheel bogies, the weight of each locomotive being approximately 50 tons when fully loaded. Each locomotive will be equipped with a six-cylinder 350 B.H.P. high-speed oil engine, manufactured by William Beardmore and Co., Ltd., of Glasgow, coupled to a 200-kW direct-coupled generator feeding four axle-hung traction motors rated each at 85 B.H.P. on the one-hour rating at 600 volts; and (*c*) from the tramways department of the Blackpool Corporation for twenty-two tramcar motors of type W.T. 28 L., rated at 50 H.P. on the one-hour rating at 500 volts.

BOROUGH POLYTECHNIC INSTITUTE.—Mr. G. E. Draycott, Head of the Engineering and Building Trades Department of the Borough Polytechnic, London, S.E. 1, is retiring at the close of the current session after thirty-one years in South London, he having been formerly for eight years at the People's Palace Technical School in East London. The Governors of the Institute have appointed Mr. F. H. Reid, B.Sc., M.I. Mech. E., M.I. Mar. E., formerly of Northampton Polytechnic and now Head of the Engineering Department at Sunderland Technical College, to succeed Mr. Draycott.

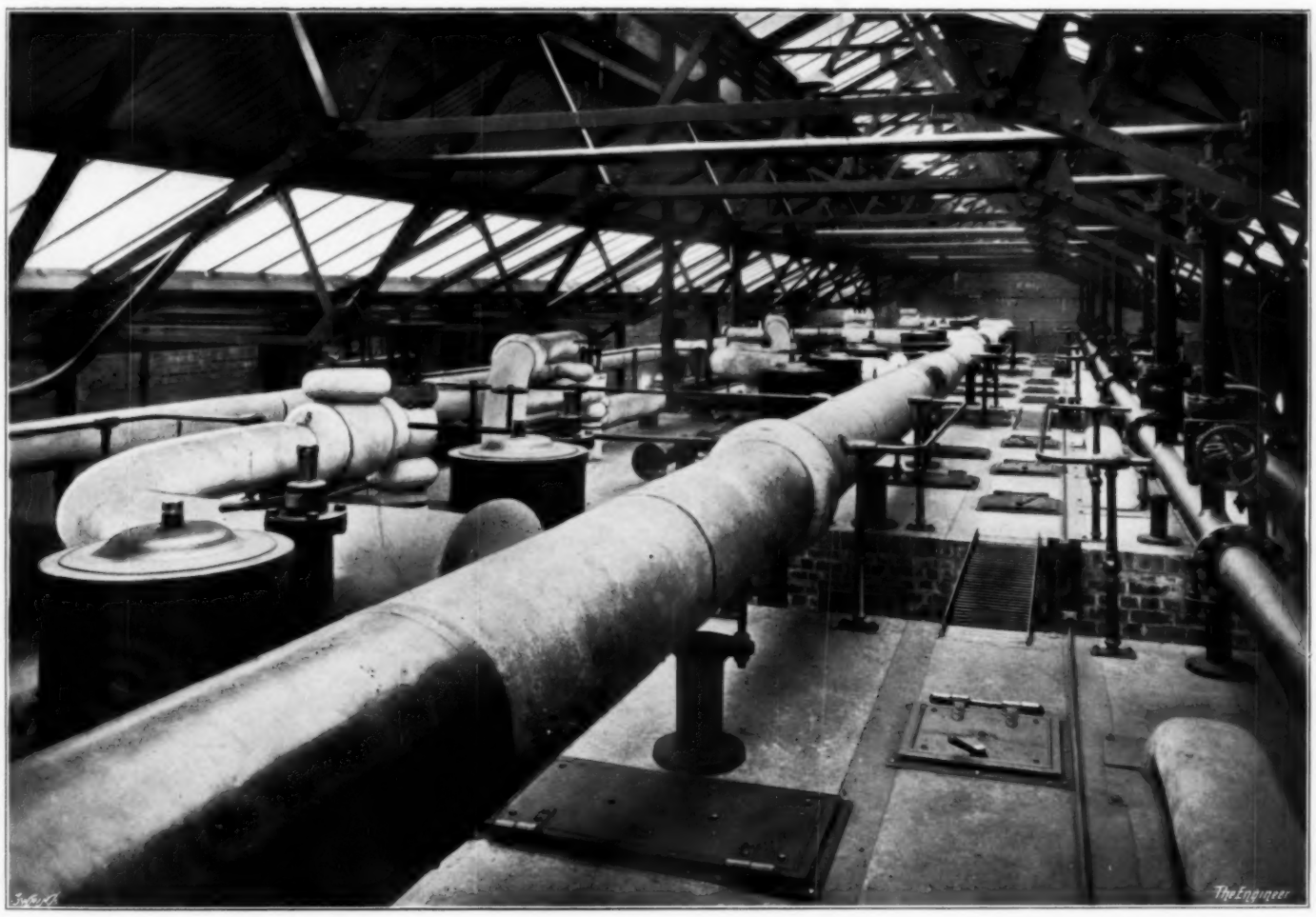
THE PADIHAM ELECTRIC GENERATING STAN

No. I.—View Along Firing Aisle

No. III.—Steam Range Operating Gallery



No. II.—End of Boiler-House



No. IV.—View Along Tops of Boilers